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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. IX. NEW YORK, FEB. 12, 1887. No. 7.

IN view of the meeting at Philadelphia next week, we need offer no excuse for the space devoted in our columns this issue to that city. Our illustrated articles on the Brush electric light station, the City Electrical Department, the Franklin Institute, and Franklin himself, will be found at once timely and interesting.

IT will be noticed that THE ELECTRICAL WORLD consists this week of no less than 40 pages—14 of reading matter and 26 of advertisements. The variety and originality of the contents, as well as the number and excellence of the illustrations, bear evidence to the manner in which the paper keeps abreast of all that is the latest and most worthy of notice in electrical science and application; while the demands made on its advertising space are sufficient to prove how thoroughly it is appreciated as the medium for reaching all who purchase electrical goods. THE ELECTRICAL WORLD is preferred by the workers and thinkers of electricity as the journal through which their ideas shall be brought to public attention; it is also the choice of those who wish to draw attention to the machines and materials that they furnish, for whatever branch of the science and industry. Such support and approval on all sides, not only here but abroad, where its articles are more and more quoted, must of necessity encourage the paper in its resolve to be and remain the leading electrical journal of America, fair in its spirit, independent in its treatment of subjects, the first to recognize merit in new inventions, and the last to admit that either it or the science it represents has any limitation to growth and usefulness. There is perhaps one new feature in the development of electricity deserving comment at this time, and that is the call that electrical applications to-day are making on the resources of mechanical and engineering skill. Our advertising pages contain this week between forty and fifty announcements of appliances and apparatus other than electrical, but which are to-day of the first importance in electric lighting and the electrical transmission of power. The better to bring these to the notice of our readers, and the easier to make reference to them, we have classified them under the heading of "Business Notices." As mention is there made of the specialty in each case, we thus furnish a very convenient and serviceable directory of what may be termed the mechanical department of the business.

IF present anticipations are realized, the meeting of the National Electric Light Association in Philadelphia next week will be unusually important and helpful. It is now certain that the attendance will be very large. All who visit Philadelphia for the convention may depend on a hearty welcome there, and will be more than repaid their trouble and expense by the good they derive from meeting those who are similarly engaged in business and by the information they obtain from the papers and discussions.

IN its third report, the New York Subway Commission gives reasons why it should have its existence continued. It says that the work now laid out could not be more than one-third completed by next November, when the Commission expires by limitation, and it still has to consider applications for space for about 25,000 miles of wire. The commission is also anxious to have its province of action, its supremacy, and the constitutionality of its proceedings settled by interpretation of the Legislature.

OUR American cities are proverbially lavish in their expenditures for improvements, and all those who have seen Philadelphia's new city hall, now nearing completion, will admit that that city is not behind the age in this respect at least. There are few buildings on this continent that can compare with it in proportions or beauty of style, and the illustrations which we give of a few rooms devoted to the electrical department will show that the latter is situated in as pleasant quarters as could be found anywhere.

A CORRESPONDENT in another column draws attention to an error which has crept into the report of Prof. Plympton on underground wires in Europe. As we showed in the article descriptive of the Edison Milan Station last week, the entire network of conductors is underground, and, as our correspondent points out, even the arc light wires are so placed. Prof. Plympton, in the short time he spent abroad, probably could not take the time to sift out the authenticity of all the information given him, and hence the unintentional mistake.

SHORTLY after our description of Mr. Frank J. Sprague's system of electric motors, one of our London contemporaries published a number of articles and communications from Profs. Ayrton, Perry, Thompson and others in which the originality of the methods adopted by Mr. Sprague was disputed. Profs. Ayrton and Perry particularly have been at great pains to prove that the system of winding the field magnets adopted by Mr. Sprague was their invention. From the challenge appearing on another page it is evident that Mr. Sprague does not propose to rest under the imputations upon his honesty as well as ability, and hence he stands willing to submit the results of his work of five years ago with that of his accusers, of the same date. The gentlemen to whom the challenge is issued are therefore offered a good opportunity of verifying their statements, and certainly nothing could be more conclusive than the actual construction of machines according to the individual designs of each at the period specified.

As new systems of electrical distribution make their appearance, the question naturally suggests itself whether the older ones already in use will be discarded. Mr. M. M. M. Slattery, in a paper which is printed in another column, sees in the new system of distribution, in parallel with high potential alternating currents acting upon transformers, a panacea for all the evils with which the older methods of distribution are said to be afflicted, but there are many who will flatly deny his sweeping assertions. That the system preferred by Mr. Slattery has its advantages and field of operation must be admitted, but it would be unwise to assume that it will supplant all others. Each system is adapted to a particular location or condition of working, and where one might be successfully worked the other might prove a failure. They all have their field, and each one has a *raison d'être* like the system of secondary distribution itself. Mr. Slattery has the courage of his convictions, however, to a notable and enviable degree.

WE regret to announce the death, on Tuesday of the present week, of Mr. Joseph Christie, for more than a decade an able and highly esteemed contributor to the columns of THE ELECTRICAL WORLD. Mr. Christie was born in Manchester, England, but came to the United States while young, and resided in Philadelphia almost continuously since. For the past eleven years he was one of the Philadelphia representatives of the Associated Press. He was a man of ripe scholarship and of wide reading, and possessed charms of mind and a sterling worth of character that made him many friends. He was in an eminent degree kindhearted, sympathetic and generous, keenly appreciative of merit in others, and always ready to deny himself to aid any one in misfortune. His death will come home as a personal bereavement to all who enjoyed his acquaintance. Two weeks before his death, he wrote with his own hands a letter—doubtless the last he did write—to the publisher of THE ELECTRICAL WORLD, between himself and whom a warm personal friendship had long existed.

THE great length of circuits required in electric street lighting seemed for a time to put a barrier in the way of the adoption of the incandescent lamp for that purpose, and the arc light naturally took a strong and permanent hold on that branch of service. It was seen that the multiple arc system of incandescent lighting could probably never be made to fully serve the purpose. Mr. Edison is, however, said to have remarked, "What I set out to do was to supply a light which would displace gas, wherever that could be successfully used," and hence, to fulfill his intentions, he in time adopted what is known as the municipal system of lighting, which is nothing more than the connecting of incandescent lamps in series on the same circuit. This system is now for the first time described, and the article on it in another column should be be of special interest to electric light men. Many cities provided with electric lights have suburbs or outlying districts in which it does not pay to place arc lamps, and yet which could be efficiently lighted by incandescent lamps. The small attention required by the latter, and the simultaneous lighting and extinction of the lamps, together with the small size and cost of the circuits, seem to point to an extended usefulness for the system.

QUITE a number of devices have been employed in the past providing for the maintenance of incandescent lamps on arc lamp circuits, and, judging from experience, this method of combining the two lamps on the same circuit has proved a profitable one. The most usual method employed thus far has consisted in coupling the incandescent lamp in multiple series, and providing a safety device so that the remaining lamps are not endangered by the breaking of a filament. It will strike our readers as most ingenious, however, that induction lamps can be maintained on a continuous current arc circuit without interrupting the current leading to the arc lamps. Mr. Ph. Diehl, whose meritorious work we have already had occasion to bring before our readers, has devised quite an ingenious system, which is described in another column. The incandescent lamps employed by him are of his well-known induction type. These he arranges in two branches between the arc lamps, and by employing a revolving interrupter alternately breaks the current in either branch, but leaving it continuous on either side of the branches. In this way no safety devices are required, as the full strength of the arc current passes unbroken through the primary of each lamp. Not the least interesting point in Mr. Diehl's system is the method employed for regulating the brilliancy of the lamp at will, by making the soft iron core of the induction coils adjustable, so that it can be withdrawn to any extent, with the result of lessening the intensity of the light.

The Franklin Institute and Its Work.

At a time when the convention that represents the great electric light industry of America is called in Philadelphia, some notice of the Franklin Institute will be found interesting, in view of the great services of that organization to all the leading practical applications of electricity.

A GLIMPSE OF THE FRANKLIN INSTITUTE LIBRARY.

The Institute was founded in 1824 for the promotion of the mechanic arts, and has from its very start been most honorably and prominently connected with their growth and progress. It held in the year of its foundation the first exhibition of American manufactures in this country. In 1826 it began the publication of its *Journal*, a valuable record of work in science and the useful arts, and now, in its fifty-first year, more highly esteemed than ever.

The hall of the Franklin Institute was begun in 1825, when the cornerstone was laid. We illustrate it on this page, giving also a view of the library. The hall is a large, substantial, though not ornate, structure of blue stone, situated in Seventh street, between Market and Chestnut. It has been occupied by the Institute from 1825 down to the present time, but has long been inadequate to the needs of the members. It has a good lecture room, library, laboratories, class-rooms and offices, but all are too small. The library is one of the finest of its kind in America, containing all the standard and current works on engineering, mechanics, physics, chemistry, metallurgy, electricity, etc., and its files of periodicals, patents, etc., are without rivals in the country, making the library extremely valuable for purposes of reference. Beyond its literary treasures, the library is rich in famous relics. It contains, for example, the electrical machine of Dr. Franklin, Godfrey's original quadrant, original Morse telegraphic apparatus, old models of Oliver Evans' high pressure engine and many others.

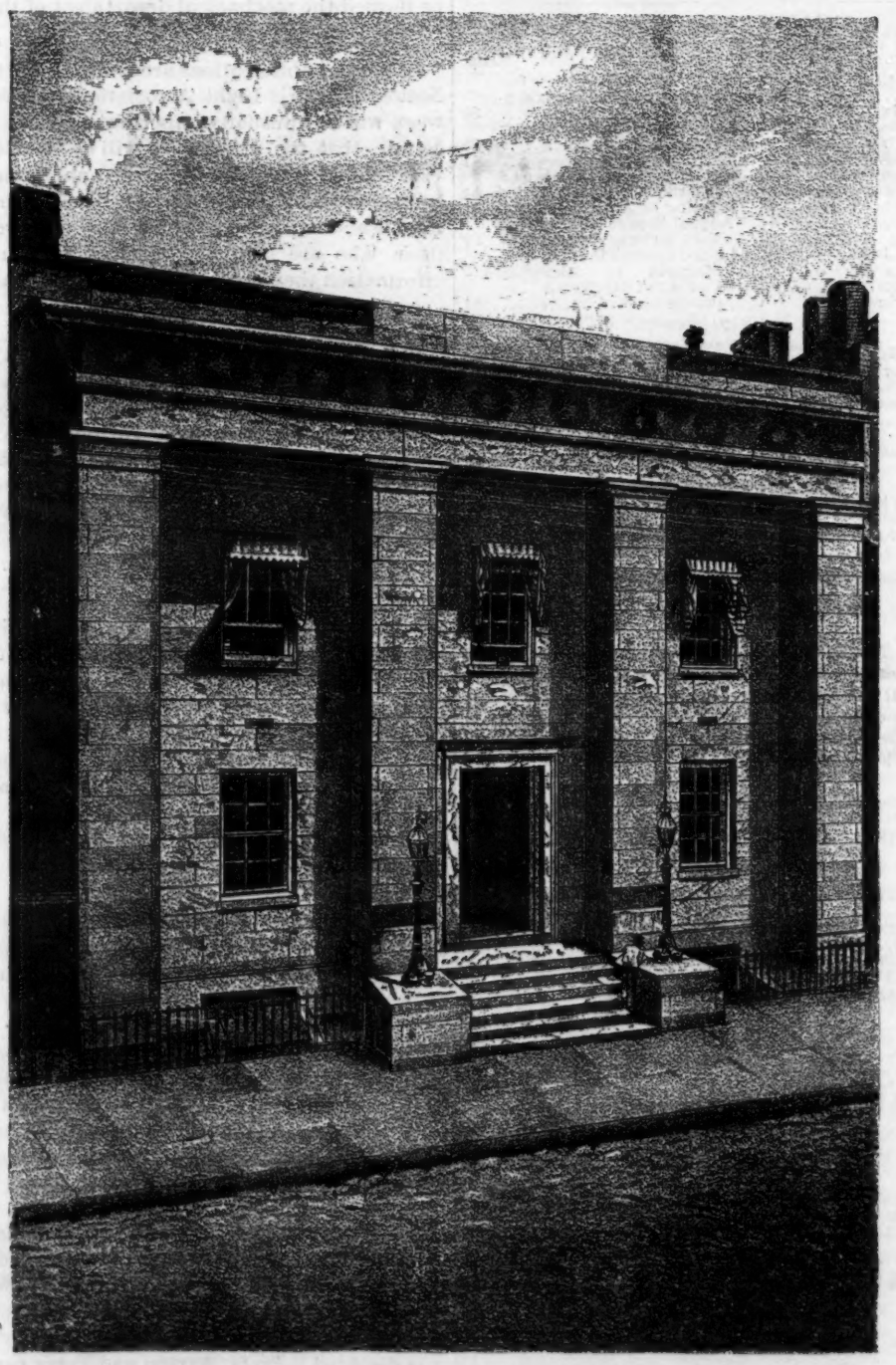
A special feature of the Institute's work has been its classes and its lecture courses. The latter are contributed to by leading scientists and workers, and always include electrical investigation and achievement. The Institute has also greatly distinguished itself by its able special reports and tests on steam boiler explosions, standard screw threads, water-power, electric lamps, dynamos, etc.

One of the most successful efforts of the Institute was the International Electrical Exhibition given in Philadelphia under its auspices in 1884, to commemorate its jubilee. The exhibition lasted six weeks in September and October, was visited by 300,000 people, was filled to overflowing with interesting exhibits, was lighted solely by electricity, and earned a handsome surplus. A magnificent memorial library was formed of electrical books given to the Institute, and various machines, etc., were also presented to it by exhibitors. There can be no doubt that the exhibition greatly stimulated electrical development, especially in the field of electric lighting. During the exhibition, the National Conference of Electricians held meetings of one week's duration in the city, partly in the hall of the Institute, and a special series of electrical lectures was delivered in the exhibition annex.

We would recommend that all visitors to the electric light convention pay a visit to the Institute. They will be greatly interested, and will be most cordially received by Dr. Wahl, the secretary. They will find the Institute abreast of the times, with its electric lights, and will certainly wish that the governing body and members may soon realize their laudable ambition for a larger and finer building.

Gas Companies in the Electric Light Business.

We have on various occasions drawn attention to the manner in which the gas companies are devoting their attention to the electric light business, and have given all the cases in which, up to date, steps have been taken in the new direction. Our enterprising and energetic gas contemporary, *The Progressive Age*, has now studied the subject from its own point of view, and in its February issue gives the results of a series of investigations conducted by correspondence, the object of which was to elicit definite and accurate information under this important head.



FRANKLIN INSTITUTE, PHILADELPHIA.

In the first place, it publishes answers from nearly twenty local gas companies as to their experience with the electric light, and the overwhelming weight of evidence goes to prove that they are doing well with it, and are satisfied. In some cases they frankly admit that the arc light is *the* light for the streets, and they state that the use of electricity has had a notable effect in increasing the consumption of gas.

The most interesting part of the "symposium," if it may be so termed, is that to which the parent electric lighting companies contribute. Thus Mr. E. H. Goff, president of the American Electric Manufacturing Company, says:

"Since the development of what is now so well known as the American system of electric lighting, we have established electric lighting stations in connection with the following well-known gas companies, to all of whom we refer as to the character of the American system, as well as to their experience with the American Company in its business methods of dealing with the gas companies and its customers generally: Brookline Gas Company, Brookline, Mass.; Citizens' Gas Company, Orange, N. J.; St. Paul Gas Company, St. Paul, Minn.; Citizens' Gas Company, Jacksonville, Fla.; Tacoma Light and Water Company, Tacoma, W. T. There are some fifteen other gas companies in different parts of the United States, with whom we are working in close alliance, which I cannot for obvious reasons name in this letter, but may be able to do so in the near future. We are now in correspondence with a large number of prominent gas men in various parts of the country, with a probability of some forty or fifty of the best known gas companies in the United States adopting the American system during the coming year."

Mr. C. A. Coffin, speaking for the Thomson-Houston Company, says:

"The Thomson-Houston Company are now working this system in connection with gas companies in the following cities: Utica, N. Y.; Birmingham, Conn.; Lafayette, Ind.; Oakland, Cal.; Emporia, Kan.; Davenport, Ia.; Leavenworth, Kan.; Columbus, Ind.; Jacksonville, Ill.; Birmingham, Ala.; Youngstown, O.; Wichita, Kan.; Beverly, Mass.; Waltham, Mass.; Ashland, Pa.; Crawfordsville, Ind.; Richmond, Ind.; Galesburg, Ill.; Selma, Ala.; Manchester, N. H.; Keene, N. H.; Putnam, Conn.; Norwich,

Conn. It should be stated, however, in this connection, that in some instances the name of the company operating the electric lights is not the same as that controlling the gas company, but that they are both in the same interests and owned by the same stockholders."

The Brush Company reports a partial list as follows: Evansville Gas and Electric Light Company, Evansville, Ind.; the Sandusky Electric Light, Fuel Gas and Supply Company, Sandusky, O.; the Oshkosh Gas Light Company, Oshkosh, Wis.; the Burlington Gas Light Company, Burlington, Vt.; the Charlestown Gas Company, Charlestown, Mass.; the Lockport Gas Light Company, Lockport, N. Y. It should be noted here that at Lockport the gas company is also using the Edison "Municipal System." It also deserves record that the connection of the Evansville Company with the Brush system dates back to 1882.

The United States Company says: "The only gas company—as a gas company—which has introduced our incandescent system in connection with its gas business is the St. Paul Gas Light Company, St. Paul, Minn. In a number of towns, as for instance, Buffalo, N. Y., Cambridge, Mass., parties owning the gas company have formed a separate organization for electric lights."

The Fort Wayne Jenney Company reports thus: "The following gas companies are using our apparatus: Stockton Gas Light and Heat Company, Stockton, Col.; Seattle Gas Company, Seattle, W. T.; Davenport Gas Light Company, Davenport, Ia.; Batavia Gas Light Company, Batavia, N. Y. We have a large number of gas companies with whom we have contracts, and will put in plants as soon as they can get city contracts."

The Edison system is in use by the gas company at Lockport, N. Y., and the Westinghouse Company reports having negotiations on hand with several gas companies.

This is as far as our contemporary's returns go, and though not quite exhaustive, it is enough to show the tendency of feeling and action on the part of the American gas companies. The same change of front is observable on the part of the gas interests in Europe.

Quite So.—When railroad trains are run, heated, and lighted by electricity, we shall have no wrecks from boiler explosions, no smoke and cinder nuisance, no setting of the country on fire from sparks, no burning to death of passengers from coal stoves and oil lamps. Then, with well constructed tracks, trains may be run at the rate of 70 or 80 miles an hour in comfort and safety.—*Cincinnati Commercial Gazette.*

The Philadelphia Brush Electric Light Station.

One of the largest arc light stations in this country is the Brush station in Philadelphia, the arrangement and management of which is well in accord with the acknowledged thrift of the Quaker City inhabitants.

In describing the station, it may be well to divide the subject under the heads of motive power and dynamo-room. Beginning with the former, we naturally take up the original source of power, the boiler, first.

The boiler room is situated on the ground floor of the building and is 67 ft. wide and 82 ft. 10 in. long. It is considered to be the most pleasant fire-room in the city, being well ventilated, light, airy and cool. Indeed, it is said to be the coolest place around the station in summer time. In the boiler room are situated sixteen boilers. Of these, twelve are of the single tubular type, and have neither drums nor domes. The steam pipe connections are taken direct from the shell of the boilers and connect to an eight-inch pipe from which the connections are taken to supply the pair of Corliss, eight Porter-Allen, one Southwark and one 6×7 in. vertical shop engine. These boilers were built by Robert Wetherill & Bro., of Chester, Pa.

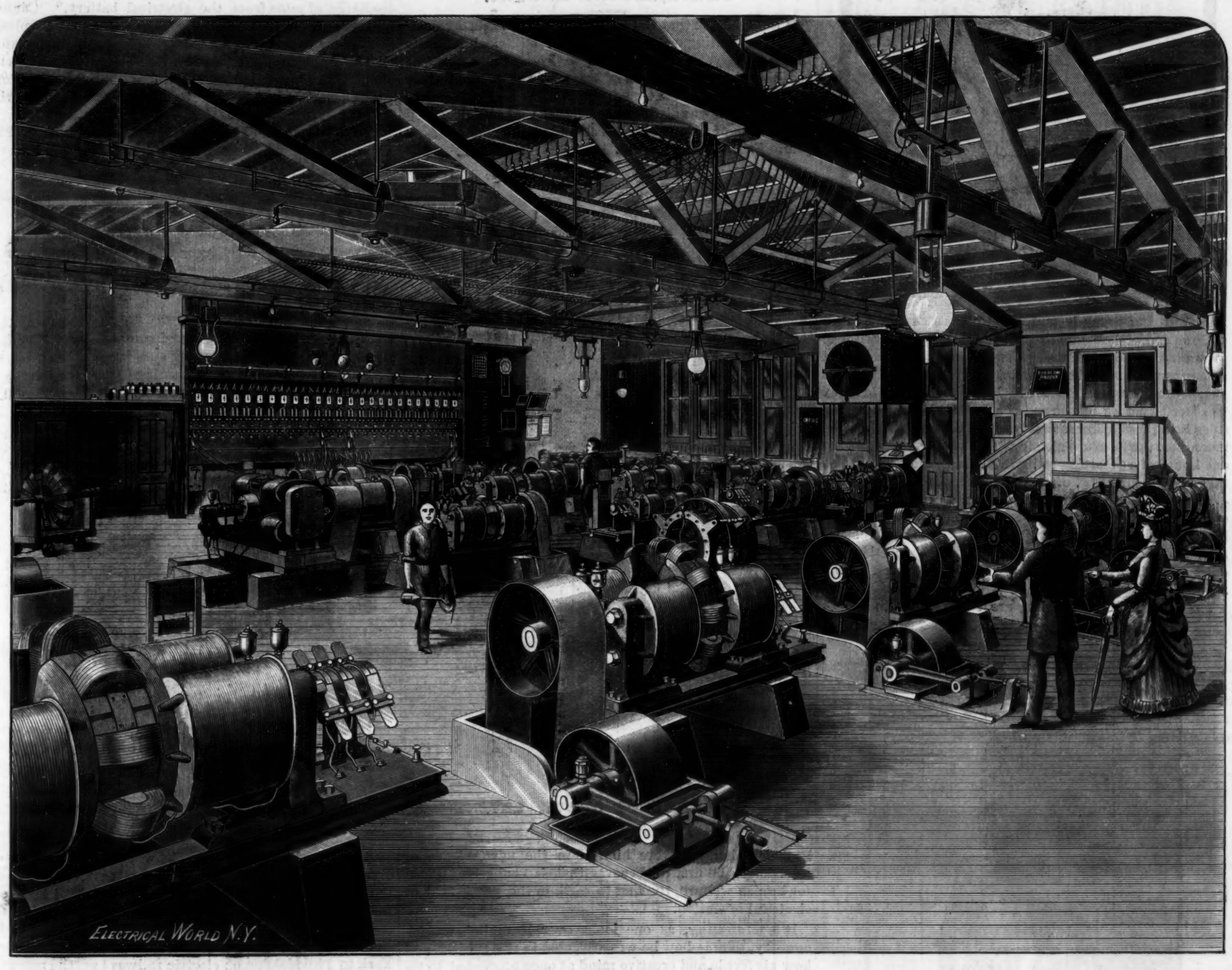
The four remaining boilers are of the Babcock & Wilcox type and are rated at 75 h. p. each. They, also, are independent, and are kept as reserve boilers.

A pressure of 110 pounds to the square inch is carried on the boilers, when running the afternoon and night load, and the engines are all high-pressure non-condensing. The coal is dumped directly in front of the boilers, requiring but one handling to the furnaces. The boilers are fed by two 6×6 in. belt pumps, and one Worthington duplex steam pump, as a reserve. The pumps are controlled by the firemen in the boiler room, who thus never have occasion to leave the boiler fronts. Without undesirable crowding, six more tubular boilers could be placed in position, so that the station is prepared for the growth which is steadily going on as the result of good work.

The engines used for driving the dynamos are eleven in number. First in point of size are a pair of engines of the Corliss type, built by R. Wetherill & Bro., of Chester, Pa., in 1882, and which have been run continuously day and night since that time. The cost of repairs has been very slight. These engines have cylinders 23×48 inches, run at 75 revolutions per minute, with a piston speed of 600 feet per minute, thus approaching very closely high-speed engine practice. The cranks are keyed to the shaft at right angles to each other. The band-wheel is 20 feet in diameter, 38-inch face, and weighs 17 tons. The main belt is 38 inches wide and 125 feet long, of 3-ply leather. This pair of Corliss engines drive ten 60-light, two 30-light and one 20-light arc dynamo.

Next in order of size come eight Porter-Allen engines and one Southwark engine built by the Southwark Foundry and Machine Co. of Philadelphia. The Porter-Allen engines have cylinders 8 × 16 inches, running at 300 revolutions per minute, with a piston speed of 800 feet per minute. Each engine has a band wheel, 56 inches in diameter and 12-inch face, and each drives a 60-light dynamo direct, with a 12-inch leather belt 37 feet long. The Southwark drives a 75-light incandescent machine.

The line shaft driven by the Corliss engine is 6 inches in diameter and 68 feet long. The counter shaft is fifty-eight feet long, reducing from 4 inches, and both lines run at three hundred revolutions per minute. The line shafting was made 6 inches in diameter, so as to couple another pair of Corliss engines to the end of it when needed, which is now the case. The shafting is on a brick foundation to the floor-level, the pillow blocks being set on plates which are bolted to the brick foundations, and the posts which support the second story floor resting on each end of the plates. The oil to the shafting is fed by gravity, through pipes to the bearings. The oil has been used over and over again four years and five months, and is better to-day than it was when first used, being now pure oil.



DYNAMO ROOM OF THE BRUSH ELECTRIC LIGHT STATION, PHILADELPHIA.

The dynamo room, which is situated immediately above the engine room, is illustrated in the accompanying engraving. It is 64 feet × 67 feet, and contains sixteen 60-light, two 30-light arc and one 75-light incandescent machines. All the dynamos are provided with dials, which are set close to the machines, where they are under the control of the machine man when putting on circuits.

The switch-board is placed at one end of the room, four feet from the wall, and has spring-jacks for forty circuits. These spring-jacks and plugs were first used by this company in November, 1881, and many of the original ones are still in use. Similar ones have also been adopted by other companies.

A spring ammeter is provided for each dynamo, and each circuit has a current indicator for detecting any reversal of a circuit. These are placed on the switch-board,

where they are in plain sight, and can be readily seen from all parts of the room. They are found to be of great importance, and Mr. M. D. Law, the able and indefatigable electrician in charge of the station, considers that no station is complete without them.

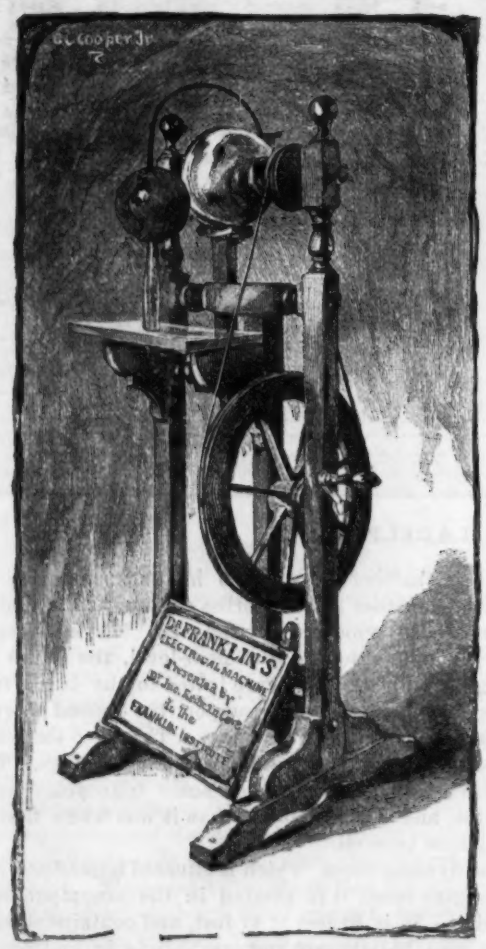
At one end of the switch-board there is an annunciator

PHILADELPHIA'S FIRST ELECTRICIAN.

for indicating grounds, and as soon as a circuit is taken off, one end of it is connected through the annunciator to ground. This is found very useful in the detection of swinging grounds. A Partz battery is employed for this purpose, as there is too much leak on the lines in rainy weather to permit of the use of a Leclanché battery. Besides being tested immediately after being taken off the machines, the lines are also tested at 12:15 P. M. and again one hour before starting to light. A resistance test is also taken in the morning, of which a record is kept.

From the switch-board the lines are all taken up into a cupola which is 15 ft. 6 in. × 32 ft. 6 in. The cupola has windows along its entire length for the sake of ventilation, which can be regulated by ropes attached to the windows and which are brought down to the back of the switch-board.

The offices, two in number, are situated on the same



FRANKLIN'S ELECTRICAL MACHINE.

floor as the dynamo room, as is also the store room from which all supplies are dealt out. On the same floor also is the machine shop in which all the repairing is done, and in which the manufacture of some of the supplies is carried on.

At the present time 776 arc lights are maintained from this station, of which 607 are commercial lights and the remaining 167 street lights furnished to the city. Besides this, 192 90-volt incandescent lamps are run on the arc circuits with Brush regulators, and 48 of the same lamps with Little-McDonald cut-outs. In addition 160 Stockwell and 16 Edgerton motors are supplied with current from the station.

There are over 100 miles of wire on poles, and all lamps within the buildings, as well as all loops branching off the main lines, are controlled by the Law cut-outs. At the present time, also, the company is erecting several large private plants for arc and incandescent lighting.

Among those prominent in the management of the company are Mr. Henry Lewis, the president, and Mr. A. J. De Camp, its secretary, the popular chairman of the executive committee of the National Electric Light Association. The station is in charge of Mr. M. D. Law, to whose efficient management as electrician much of its success is due. In fact, the entire equipment and arrangement and the results obtained are such as to reflect credit on all concerned, and to deserve the careful study of all electric light men who are visiting Philadelphia.

Philadelphia's First Electrician.

It is impossible that the National Electric Light Association, representing one of the greatest electrical interests in the country, should assemble in Philadelphia without recalling the life and work of one who was not only first among the men of his time in patriotism and statesmanship, but who was distinguished by his zeal and success in the domain of electrical research and investigation. Benjamin Franklin was the first American, as well as the first Philadelphian, to devote himself to the new science of electricity, the first to discover that it could be utilized for human welfare, the first to work in the great field of electrical invention.

It is interesting, as one looks over Franklin's autobiography, to note how he was attracted to this subject, and how his fertile and creative mind at once proceeded to results. "In 1746, being in Boston," he says, "I met there with a Dr. Spence, who was lately arrived from Scotland, and showed me some electric experiments. They were imperfectly performed, as he was not very expert, but, being on a subject quite new to me, they equally surprised and pleased me. Soon after my return from Philadelphia, our library company received from Mr. Peter Collinson, Fellow of the Royal Society of London, a present of a glass tube, with some account of the use of it in making such experiments. I eagerly seized the opportunity of repeating what I had seen at Boston, and, by much practice, acquired great readiness in performing those also which we had an account of from England, *adding a number of new ones.* I say much practice, for my house was continually full for some time with persons who came to see these new wonders." Franklin then, it will be remembered, goes on to describe his encouragement of and work with Kinnersley, and tells how the reports in Europe of his work and ideas led to his being elected a member of the Royal Society and to his being awarded its gold medal. Franklin's lightning rods won their way in spite of the French Abbe Nollet's assertion that it was "as impious to ward off Heaven's lightnings as for a child to ward off the chastening rod of its father," and Franklin's opinion that the conductors should be pointed instead of blunt was accepted in spite of King George's notion that those with points were a "republican device calculated to injure His Majesty." His determination of the identity of lightning with electricity sufficed to give him universal fame and reputation.

Franklin was not only the first of American electrical inventors but he was also as brilliantly versatile and quick to see means and applications as any modern Edison. Take, for example, as peculiarly appropriate to the week of electrical reunion in Philadelphia, his happy proposal for an electric feast: "The hot weather coming on, when electrical experiments are not so agreeable, it is proposed to put an end to them for this season, somewhat humorously, in a party of pleasure on the banks of the Schuylkill. Spirits, at the same time, are to be fired by a spark sent from side to side through the river without any other conductor than the water; an experiment which we some time since performed to the amazement of many. A turkey is to be killed for our dinner by the electric shock and roasted by the electric jack before a fire kindled by the electric bottle, when the healths of all the famous electricians of England, Holland, France and Germany are to be drunk in electrified bumpers, under a discharge of guns from the electrical battery." Cannot we realize, even from this little piece of scientific pleasantry, how thoroughly Franklin would have appreciated all the applications of to-day—the telegraphs and telephones, the electric lights and motors, the ozone machines and the electric bells, the very poles and wires along the streets?

Perhaps it was well for later American electricians that Franklin died when he did, full of years and honors. Had he lived much longer, he would have anticipated every electrical invention of the Nineteenth Century, and have had a priority claim to every patent. Had he lived, we should probably have been obtaining current directly from coal, and navigating the air in balloons propelled by electricity, as well as making the journey from New York to Philadelphia on electric railways at the rate of a hundred miles an hour. The genius who no sooner heard casually of the English experiments than he improved on them, "adding a number of new ones," needed but greater length of years to arrive at the highest results of invention in electricity.

FRANKLIN'S GRAVE, SEVENTH AND ARCH STREETS, PHILADELPHIA.

The Washington Monument.—A special dispatch from the national capital, says: The interior of the Washington Monument was lighted from top to bottom recently with 75 incandescent electric lights, and the effect was very striking. The object of the illumination was to ascertain if the electric lighting apparatus is in order, as it had been somewhat disarranged by the contractors in reconstructing the elevator. The monument will not be lighted regularly until there is some provision for running the new passenger elevator. The electric lighting plant was provided for by the appropriation for completing the monument, as was the elevator; but there is need of congressional legislation and appropriation before either can be put into regular operation. Then visitors will no longer have to tramp up and down 500 feet of iron stairway, by the dim and flickering light of candles provided by themselves, but will be lifted rapidly through the long shaft, which will be kept almost as light as day. The motive power for the elevator will also run the dynamo, which lies alongside the elevator engine under the terrace at the base of the monument. The lights are at the stairway landing, and are fastened to brackets extending from the iron frame-work in the centre of the shaft. There are four lights at the 500-foot level, four at the bottom of the shaft and two in the pit. Each landing for the first 150 feet is supplied with two lights and the others with one light each. The effect is striking as one looks up the shaft from the bottom.

The Electrical Department of the City of Philadelphia.

The Electrical Department of Philadelphia entered its new quarters at the City Hall, with its fire-alarm apparatus, at noon on Jan. 1, this year. There is no finer city electrical department anywhere in America, and it is therefore well worthy of illustration and description, as far as can now be done. Access for the wires into the building is obtained through the underground structure by five cables, two Waring bunched with twenty-one conductors each; two Waring anti-induction, six conductors each; and one Patterson, ten conductors—a total of 64 wires. From the boxes on the poles at Juniper and Cuthbert streets the cables are dropped into a brick manhole. Thence they are carried 150 feet by a twelve-hole conduit, 14 by 12 inches, of cresoted wood, to a manhole at Juniper and Filbert streets. From this point they are carried under the street to the sidewalk, a distance of 150 feet, by an iron pipe 20 inches in diameter, floored with a two-inch plank, made to fit, and covered with asphaltum. They then proceed under the sidewalk from the street to the cellar of the building—a brick subway, 124 feet long, with dimensions 5 feet by 6 feet, six inches along whose sides are shelves

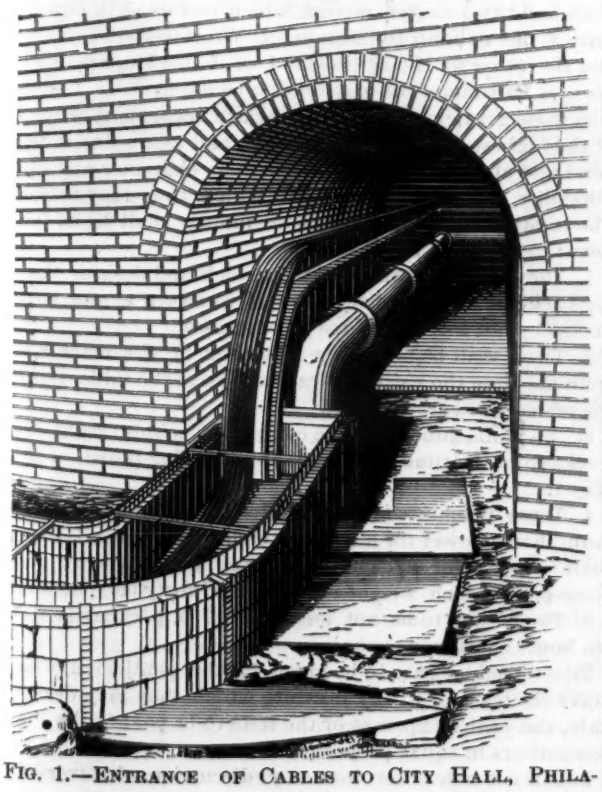


FIG. 1.—ENTRANCE OF CABLES TO CITY HALL, PHILADELPHIA.

covered with asphaltum, upon which the cables are laid. From this subway the cables drop to a conduit built of asphaltum blocks under the floor of the cellar, Fig. 1, leaving which they are carried up 98 feet on the walls of the northeast stairway on a panel of shellaced boards, Fig. 2. Thence they are carried 130 feet under the fifth floor of the building in a duct 8 × 24 inches of plate glass ½ inch thickness imbedded in the asphaltum, to the distributing board, where they take the spring jacks. The spring-jack board is of mahogany, 31 inches in length, 10 inches wide and 3 inches deep, with accommodations for 185 circuits. From this point they enter the fusible strips, 4 inches long and ¼ inch wide, of tin foil finished in vulcanized paper fibre. Thence they go to the lightning arrester. The lightning arrester is a bank of 200 arresters erected in a frame of slate, 8 feet long, 8 inches deep, and mounted in step form on slate strips; after leaving which they pass into the ducts under the floor, and thence into the bells, relays and keys, through which they successively pass to the switch-board, where they can be handled as the service may require. After passing through the numerous switches they enter the arresters at the bottom of the board and again drop to the floor, under which they pass to the western wall of the operating room, on which they ascend to the store room, where they take the battery cables which pass under the floor of the battery room to the racks where the battery is obtained. The operating room is 51 feet long, 47 feet wide and 30 feet high, handsomely furnished throughout with very massive counters of cherry and ash, with mahogany tops on which the instruments are placed. The floor of the room is of cement, with an asphaltum surface upon which is built a false floor of selected boards, planed and shellaced. Within this are built the ducts and troughs in which are laid the wires connecting the service. On the south side of this apartment is a counter running very nearly its full length, used for the police telegraph service. A backboard serves to carry the wires to the police instrument, while at the same time it is used as a base upon which are placed the call bells, thirty in number, for the fire alarm service. The relays, keys, registers and repeaters are placed upon counters in the centre of the room, while at the western end of the room is the one upon which the switch-board stands. The northeast corner of the room is partitioned off for the use of the inspector of the department. The northwest corner serves for a cot room. In the southeast corner is the telephone stand and the southwest corner is partitioned off for the use of the public. Two large desks are conveniently placed for the use of the police and fire operators. This apartment is well lighted by day, by large windows extending from the ceiling almost to the floor, while at night three large and handsome chandeliers with 18 burners each and numerous small jets around the sides of the room furnish all the light needed. The machinery is furnished by the Gamewell Fire-Alarm Telegraph Company in handsome design and of the best workmanship. The commutator or switch-board is ten feet seven inches long, made of mahogany; it is highly polished and has a handsomely carved large pillar on either end adding greatly to its appearance. On the top of the board is a bank of annunciators numbering 100, below which are the switches, 300 in number, by means of which many combinations can be made. Eighty-four of the number are coupled together in six bands of 14 each, by means of which the circuits may be switched into or out of the repeaters, as may be required. The arrangements for testing are in every way complete. At the bottom of the board are lightning arresters to the number of 100, with battery and line connections conveniently arranged to suit all purposes. On the table upon which the commutator stands are 36 battery standard galvanometers, and one galvanometer for line testing. South of the operating room is the office of the chief, David R. Walker, handsomely carpeted and furnished in cherry and ash. North of the operating room

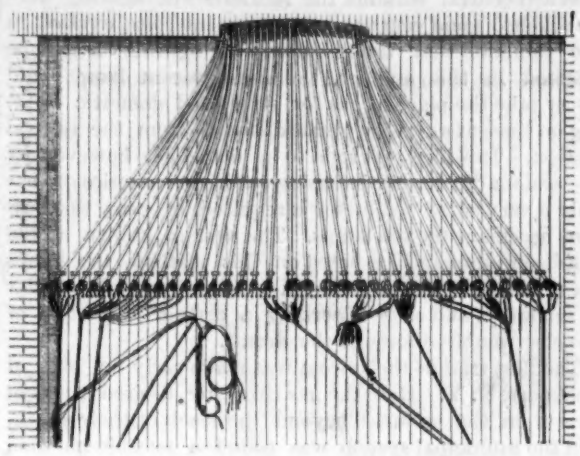


FIG. 4.—CABLE DISTRIBUTOR.

is the office of the manager, J. C. Sager, and the clerk of the department. This is fitted up in the same handsome manner as the chief's. The battery room, Fig. 3, is 77 ft. long, 46 ft. wide and 25 ft. high, well lighted by day by numerous windows and skylights, and at night by five four-light chandeliers and a number of double brackets on the sides of the walls. The battery racks, thirty in number, are of ash, with trimmings of cherry with three carved posts set in feet of heavy ground glass for insulation, and supported from cross bars. The posts at the end of each rack rise above it about two feet, where they end in a circle in the centre of which is a four-inch hole. Each row of ten racks is supported by two cylinders of polished cherry four inches in diameter let into the wall on either side, which passing through the holes at the top of the posts hold the racks firmly in position; the cross-bars are bored to admit of a porcelain insulation, which serves as a stand upon which the glass jars are placed. Each rack holds fifty cells, giving a total of 1,500 on the thirty racks. The glass jars are covered with lids of glazed clay to prevent the overflow of salts and the fumes attacking the woodwork above them. The two sinks in which the batteries are cleansed are of slate lined with lead, and finished in ash with a drip-board of the same material, with perfect arrangement for overflow, etc. Two wardrobes and a handsome book-case with French plate-glass doors of cherry and ash, and heavy chairs of oak, make up the furniture of the room.

To connect the lines in the store-room with the racks in the battery-room required 2,250 feet of cable. The Standard Underground Cable Company furnished the department with a special make of six-wire cable, resembling in appearance their anti-induction ribbon cable. These cables are carried up the western wall of the store-room and arranged in fan shape (Fig. 4) in a very neat and at the same time a very convenient way, so that any cable can be attended to without any trouble.

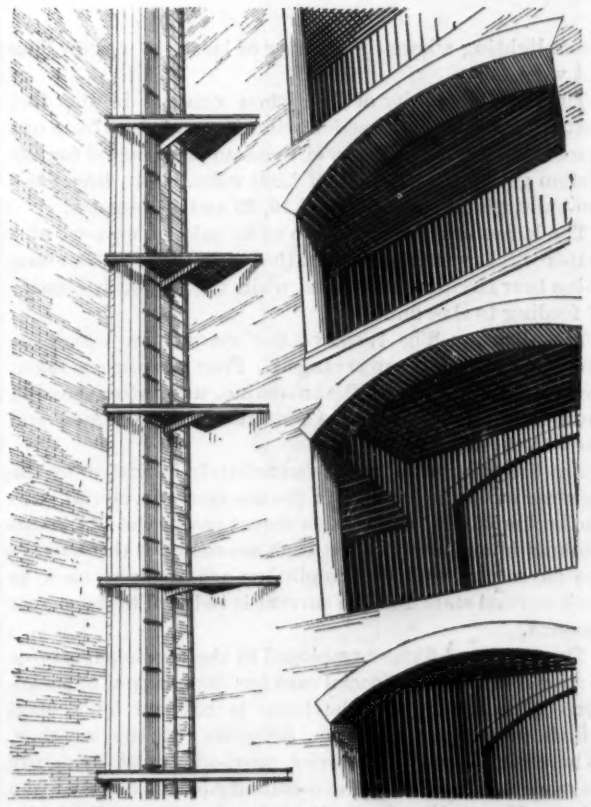


FIG. 2.—CABLES LEADING TO ELECTRICAL DEPARTMENT.

In the Supreme Court.—The hearing of the telephone appeals has been going on steadily in the United States Supreme Court, at Washington, before Judges Field, Harlan, Bradley, Miller, Waite, Matthews and Blatchford. Great prominence in the arguments has been given to the Drawbaugh case. It cannot be said that any new point has been elucidated so far at any stage of the proceedings, but the interest taken in the hearing has been great.

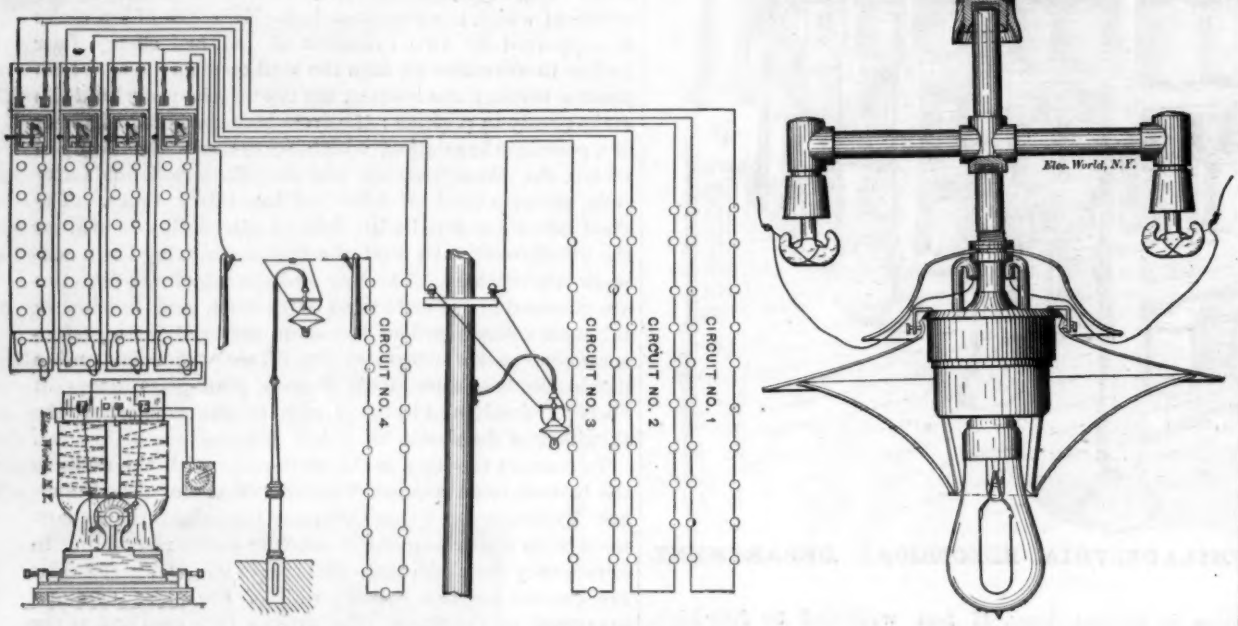
The Edison System of Municipal Lighting.

When central stations for incandescent lighting were established some years ago, the gas interests exulted in the thought that though domestic lighting might be effected in this manner, the incandescent lamp could never take the place of gas for street and domestic lighting on lines at any very great distanee from the central station. This idea was soon to be dispelled, however, by the system of running incandescent lamps in series so that only a very small conductor is required to carry the current necessary for the lamps. The system known as the "Edison municipal" is based on this method, the lamps being placed in series on a high potential circuit, similar to arc lamps and each absorbing a certain proportion of the electromotive force of the circuit.

The first trial of the system was made early in 1885 at Lockport, N. Y. Here the gas company desired to light streets in the suburbs beyond the reach of their mains, and the municipal system was found a feasible method of accomplishing this.

In Portland, Me., 280 incandescent lamps are now run on twelve circuits through heavily shaded streets, and suburban districts, in conjunction with 150 arc lights in the larger spaces. The remaining lamps, there being 500 in all, are used in printing offices and in the audience room of the City Hall. Lawrence, Mass., is also lighted by 550 lamps, Denver, Col., with 530, and various other cities on the same system.

While this system can be employed for interior lighting where the load is constant, it is especially designed for street lighting where the number of lamps in circuit does not vary.



FIGS. 1 AND 2.—THE EDISON MUNICIPAL SYSTEM.

The great flexibility of the system consists in the fact that a number of independent circuits can be run from one machine. The latest types of dynamo constructed for the system generate an E.M.F. of 1,200 volts, and three sizes are built, giving, respectively, 16, 32 and 48 ampères.

The lamps are constructed so as to take a current of 4 ampères. It will thus be seen that from the smallest machine four circuits can be run, while the largest is capable of feeding twelve circuits.

The diagram, Fig. 1, shows the manner in which the station and circuits are arranged. Four circuits are taken from the brushes of the machine, and, after passing through am-meters, the line continues to the lamps and back to the other brush.

The breaking of a lamp is immediately indicated by the increase of current shown in the am-meter in circuit with the broken lamp. When this occurs one of the six lamps situated immediately below each am-meter is thrown into the circuit, so that the conditions are brought back to their normal state and the current is reduced to its correct amount.

The lamp and fixture employed in the municipal service is shown in Fig. 2. Special care has been taken to secure perfect insulation, and the lamp is covered by a hood which protects it from the influence of the weather. Where lamps are run in series, provision must evidently be made for preserving the continuity of the circuit when a lamp-filament breaks, and this has been provided for in a very simple manner by an automatic cut-out placed in the lamp socket.

As was stated above, from four to twelve circuits can be run from different sized machines, and lamps of any candle-power, from 15 c. p. to 100 c. p., can be inserted in the circuit, each, of course, absorbing a corresponding portion of the E. M. F. of the circuit. Since the current in each circuit is only 4 ampères, only a very small wire is sufficient to carry it long distances without a very great loss, and in this way a No. 12 B. W. G. or No. 15 Edison gauge would each be capable of maintaining lamps on a ten-mile circuit with only 15 per cent. loss.

Electric Motors for Street Cars.

Electricity as a motive power is receiving remarkable, yet natural, attention in Boston. The sentiments of several street railway presidents have been obtained by a *Herald* reporter, and they show how opinion is tending. President Richards, of the Metropolitan Railroad, said: "I am thoroughly sincere in my expressed opinion that some other power will take the place of horses in the near future for moving Boston street cars. Electric roads are now running with more or less success in several cities. While the conditions regarding snow and ice are not precisely the same in any of them as prevail in Boston, the experts profess confidence in their ability to overcome all obstacles. Personally, I consider the 'storage battery' system one of the best, as it calls for no alteration of the roadbed and applies its power directly to the wheels of the cars, thus obviating the great waste which must result from using any system where the power passes a long distance through a conductor from a central station. The apparatus will be out of sight under the car, and its extra weight of 2,500 pounds, instead of being an objection, will aid in securing necessary 'traction.' I do not see why a car of the proper weight, run on a road where care is taken to plow out the tracks properly, cannot be propelled as well as locomotives on steam railroads. A revolving brush immediately in front of each wheel and a small stream of sand running upon the rails might aid the car in getting a 'grip' in the worst weather. There is another system where a third rail is laid in the centre of the track, and still another where the power is obtained from wires running overhead. None of these are feasible for a city like Boston. Overhead wires may do for a country road, but it is doubtful if any company would be permitted to set the necessary row of posts here. The electric conduit, though costing much less than a cable conduit, would still be quite expensive. The third rail is raised above the level of the roadway, making an obstruction to travel, and necessitating grading over at the crossings. So the storage battery system seems to me by far the most promising of any."

In regard to the cable system President Richards said: "I don't believe in it. I have investigated the system pretty thoroughly, and seen it operate in most of the cities where it is in use, and it does not impress me favorably. I am even sceptical as to its superior economy as compared with horses, though those who use it declare that it is much cheaper. It costs an immense sum to put in the plant. It would take a million or two, to begin with, to alter the Metropolitan road so that we could use it. Expensive machinery is required, and the cables are costly and easily broken. Some of the Western roads run two cables, in order to make lightning changes in case of accident. The 'grippers' wear out fast. Again, the streets in Boston are peculiarly unfitted for the cable, being narrow in many parts and with innumerable curves to contend with."

President Hersey, of the South Boston Company, said: "The cable seemed to me a great improvement, though having several objectionable features; but recent developments in electrical appliances are such that I should not think of putting in a cable road before some of the new plans have been tested. I examine with interest all the literature I receive relating to electrical invention to be applied to street railways, and am always ready to investigate. The electric conduit strikes me as likely to prove as feasible as any I have looked into, though the storage battery may prove superior. I believe that the days of horses on street cars are nearing their end, and look to electricity to move these vehicles in the near future."

President Cummings, of the Cambridge Railroad, and President Whitney, of the proposed Suburban Street Railway, also spoke favorably of the prospects of electrical motors for cars.

Underground Wires in Milan, Italy.

To the Editor of The Electrical World:

SIR: In your issue of Jan. 1, you publish the report of Prof. W. R. Plympton, President of the Brooklyn Subway Commission. That portion of the report referring to the electric light plant at Milan is far from stating the facts, and the professor evidently derived his information from some one entirely unacquainted with the Milan station. The report states that the conductors are all overhead, whereas, in fact, those for the Edison incandescent and Siemens arc lamps are altogether underground, and also a large part of the Thomson-Houston arc light circuits.

We have at present over 9,500 Edison lamps connected to the station, and they are all supplied from the Edison underground system, which includes nearly 4.5 kilometres (3 miles) of feeders and 7 kilometres (4.5 miles) of distributing mains.

Of the 100 Siemens differential arc lamps connected to the station about 30 are outdoors, and all of these derive their current from the general incandescent network. The underground conductors leading to the lamps are Siemens armored cables having a No. 10 B. W. G. copper core. The Thomson-Houston plant, comprising at present 60 2,000 c. p. lamps, is supplied from 2 circuits, of which over 6.5 kilometres (4 miles) are underground. These conductors are special Siemens cables, having a conductor resistance of 1.29 ohms per kilometre and an insulation resistance of 12,000 megohms per kilometre.

These cables have been conveying current since June last, and continual tests have not shown any fall in insulation. The entire circuit, including lamp suspensions, aërial wires and underground cables shows an insulation to earth of 20 megohms.

J. W. LIEB, JR.,
Gen'l Man. Edison Company.

MILAN, Italy, Jan. 18, 1887.

An Electric Motor Challenge.

To the Editor of The Electrical World:

SIR: An English paper, the *Telegraphic Journal and Electrical Review*, has seen fit during the last three or four months to make several attacks upon myself. These attacks have not only been made by the editor of the paper under, it seems, necessarily a gross misapprehension of the facts, but a number of communications, which have been copied by several papers, have been published from Prof. Sylvanus Thompson, Messrs. Ayrton & Perry and Mr. William Mordey, in which they, too, have joined the hunt and raised the cry against the originality of my work.

When the numerous duties which occupy my time will permit, I will answer, in such detail as I think is necessary, these assaults. Meanwhile, I have to make the following proposition, which, if these gentlemen believe what they say, they will either accept, or else apologize for the statements which they have made:

I propose that Mr. Thompson, or Mr. Ayrton, or Mr. Perry, or Mr. Mordey, any one or all of them, and myself, shall build two electric motors, which motors shall be submitted, one to John Hopkinson, of Westminster, London, and the other to Henry Rowland, of Johns Hopkins University, Baltimore, the machines to be duplicates. I mention these gentlemen because they are recognized as men of the highest scientific attainments, and as absolutely beyond and above all question as to their character and the reliability of any test or report which they may make. The conditions for building these motors shall be as follows:

1. They shall be from working models and designs dating back not less than five (5) years; as sworn to and witnessed by not less than three (3) witnesses.

2. There shall be no change whatever in the machines from the time the working drawings leave the table until the machines are completed.

3. Such machines shall be completed within eight (8) weeks from the time they leave the drawing board, or by May 1.

4. These machines are to be tested, first, for the maximum horse-power for a given weight, and second, they shall be tested for efficiency with any given weight per horse-power, such weight not to exceed forty (40) pounds.

5. The motors to be not less than 10 h. p. capacity for ten hours continuous running.

These machines are to be given to the gentlemen who make the tests, or to any institute which they may designate, the entire expenses of the tests to be paid for by the competitors in equal proportions.

I shall not now enter into any discussion whatever of the questions that have been raised by these gentlemen; I wish them to answer explicitly and without equivocation this challenge to build machines on models of 1881 without any change whatever from that date to this.

NEW YORK, Feb. 7, 1887. FRANK J. SPRAGUE.

Fifty Dollars Not Enough.—An effort having been made to limit telephone rates in St. Louis and Kansas City to $50, the State Senate has indefinitely postponed any consideration of the proposal.

Diehl's Induction System for Operating Incandescent Lamps on Arc Circuits.

The demand created for the incandescent electric light where the arc light has been installed has called forth a number of devices for placing incandescent lamps on arc circuits. This has heretofore been accomplished by the aid of what are termed "distributors," which practically are switches connecting the lamps in multiple series in the arc circuit. A decided departure has, however, recently been made in the method of operating incandescent and arc lamps on the same circuit, and for this purpose induction is called into play in a most novel and ingenious manner. The inventor of this system, Mr. Philip Diehl, of Elizabeth, N. J., it will be remembered, showed, among other exhibits at the Philadelphia Electrical Exhibition of 1884, an incandescent lamp which was raised to incandescence by the secondary current induced in a coil placed within the glass of the lamp itself, and which was acted upon by a current circulating in an exterior primary coil.*

In the method of working employed at that time, Mr. Diehl used an alternating current machine to produce the

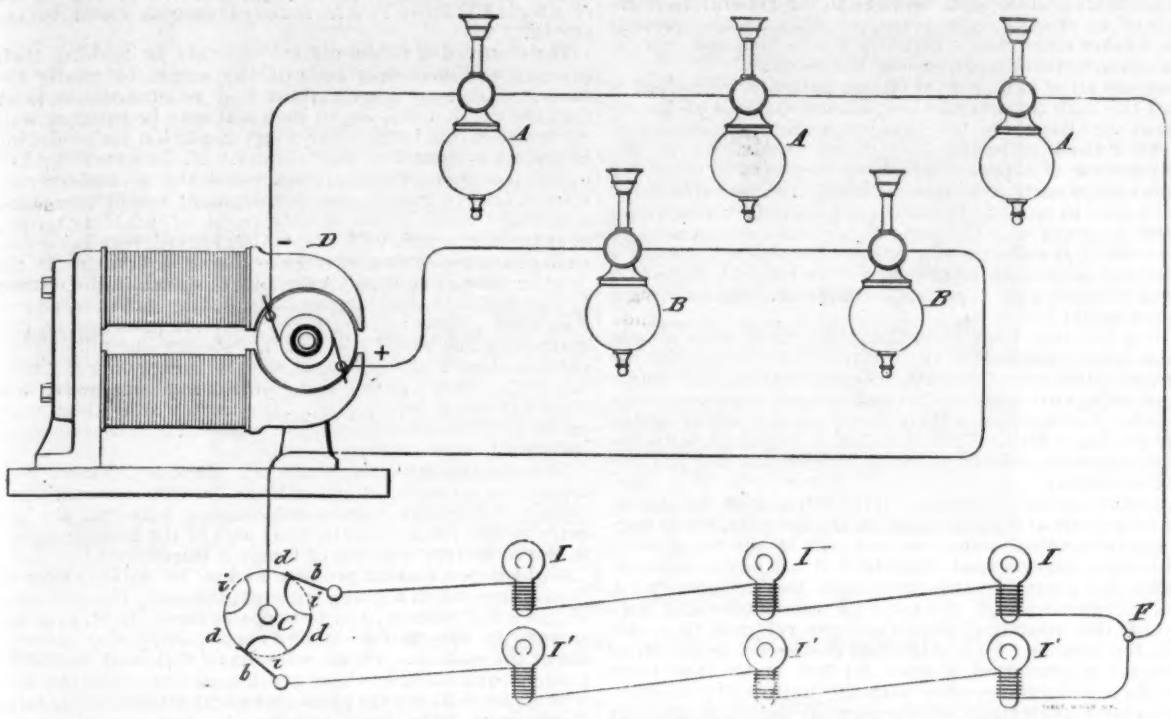


FIG. 1.—DIAGRAM OF CIRCUIT OF DIEHL INDUCTION SYSTEM.

variations necessary in the primary coil. But it is evident that when continuous currents are employed, such as on the large majority of arc circuits, some device is required for varying the current in the primaries of the incandescent lamps, while at the same time the current in the arc lamps remains unchanged.

This problem has been most ingeniously solved by Mr. Diehl in placing in the circuit an interrupter, and so connecting the incandescent lamps that they form independent paths for the main current, so that the latter is never actually broken in the arc lamp circuit. Thus, instead of employing alternating currents, he uses a continuous current, which is broken at a rapid rate.

The manner in which the lamps are connected in circuit will be readily understood from the diagram, Fig. 1. From the dynamo we will suppose that the current passes through two arc lamps *B B* and then arrives at a series of incandescent lamps to be lighted. The lamps, it will be noted, are grouped in two branches, series *I I I* and *I' I' I'*. At one side the branches are connected to the brushes *b b'*, which bear against the interrupter *C*; while at the other side they are united at *F*, and form the continuation of the circuit.

The circuit conductor is brought to the centre of the interrupter *C* which is here shown as having three conducting segments *d d d*, all joined together, and three insulating segments *i i i*. Now it will be noted that the brushes are so placed that at no time can brush *b* leave one of the conducting segments *d* before the other brush *b'* has made contact with one of the opposite conducting segments. But it will be seen that a slight revolution of the interrupter after both brushes make contact brings one of them on to an insulating strip *i*. The result is that the current will be interrupted in one of the branches *I* or *I'*, according to whether the brush *b* or *b'* is on an insulating strip of the interrupter. It will be observed, therefore, that the main current is never broken, but that it is merely shifted alternately between the two branches of incandescent lamps *I* and *I'*.

The rapid revolution of the interrupter creates the variations of current in the primary coil of the incandescent lamp which induces the requisite current in the secondary, within the lamp, to which the filament is attached.

With this short explanation of the mode of operation of the system, we come to the description of the apparatus employed in its installation. This embodies a number of ingenious and novel points.

It will be readily understood that at any one point an indefinite number of incandescent lamps may be placed in the circuit, and at each such point a current interrupter

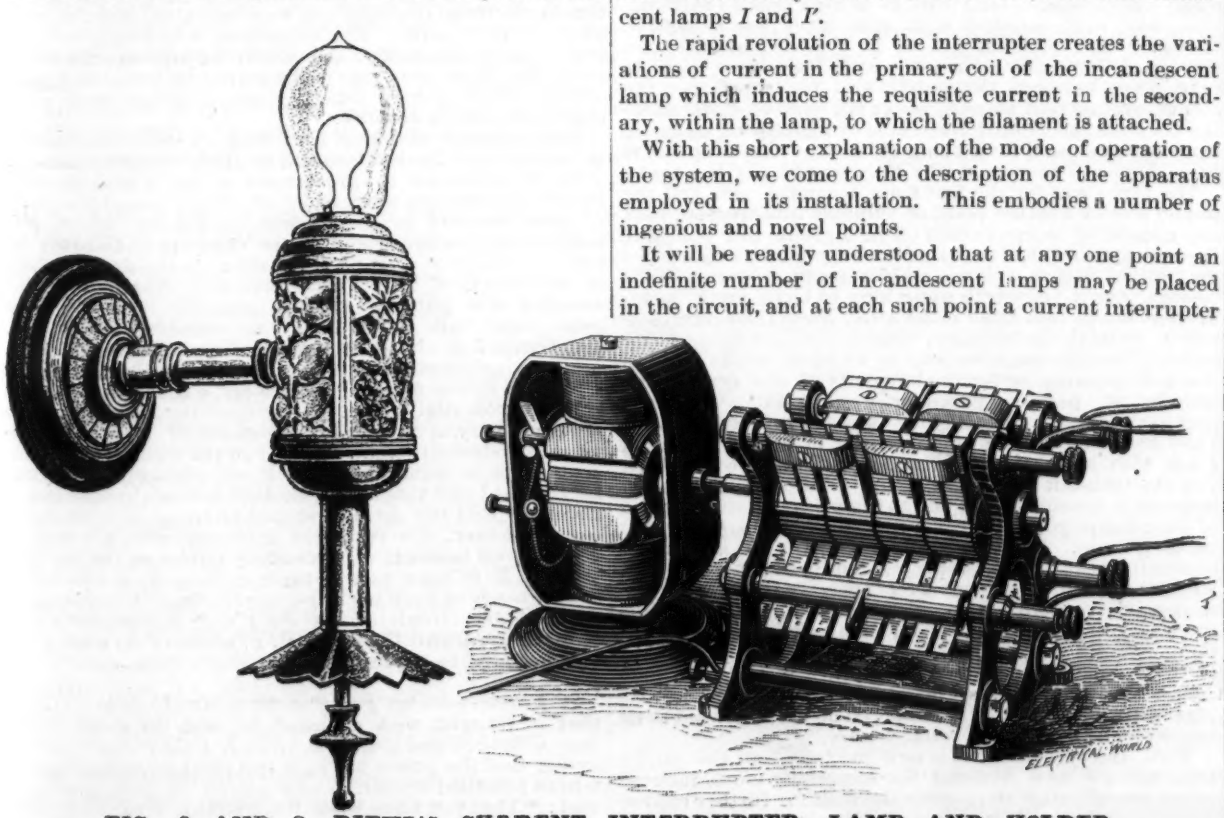


FIG. 2 AND 3.—DIEHL'S CURRENT INTERRUPTER, LAMP AND HOLDER.

is placed. The entire apparatus is shown in the engraving, Fig. 2. It consists simply of a cylinder of brass, having a number of longitudinal grooves, which are filled with strips of glass that form the non-conducting segments of the interrupter. Four sets of brushes bear against the circumference of the cylinder, each two opposite pairs being connected, so that in reality they form only a single pair of brushes. The object of the construction adopted is to secure a double length of contact without increasing the width of the brushes, and hence the length of the cylinder.

The principle of its working is the same as that shown in the diagram, Fig. 1. The interrupter is coupled direct to a small motor which drives the cylinder at a high speed, and thus effects several thousands of interruptions of the current per minute. The little motor is driven by the main current, and requires but very little power, not more than is absorbed by one or two incandescent lamps.

The lamp and the holder employed in the system are shown in perspective in Fig. 3. The lamp itself is shown in section in Fig. 4, and Fig. 5 shows the lamp and holder in section.

The lamp, as will be seen, consists of a glass globe

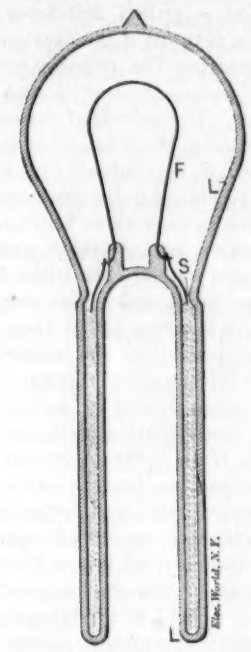


FIG. 4.—DIEHL'S INDUCTION LAMP.

having a hollow cylindrical extension, and without any leading-in wires. Within the cylindrical portion there are wound a few layers of fine wire *S*, to the ends of which the filament *F* is attached. The fine wire within the glass globe forms the secondary wire of the induction combination, the primary wire of which *P* is firmly held in the holder and inclosed within the case *E*. When inserted in the holder, the lamp fits snugly within the primary coil and the secondary wire within the glass is brought in close proximity to the former.

As the inductive effects between the wires alone would be very feeble without the addition of iron to the combination, Mr. Diehl has added the latter and at the same time disposed it so that the iron is made a regulator, by which the brilliancy or candle power of the lamp can be changed at will. It will be seen that when the lamp is placed in its holder the hollow cylinder surrounds a core of soft iron

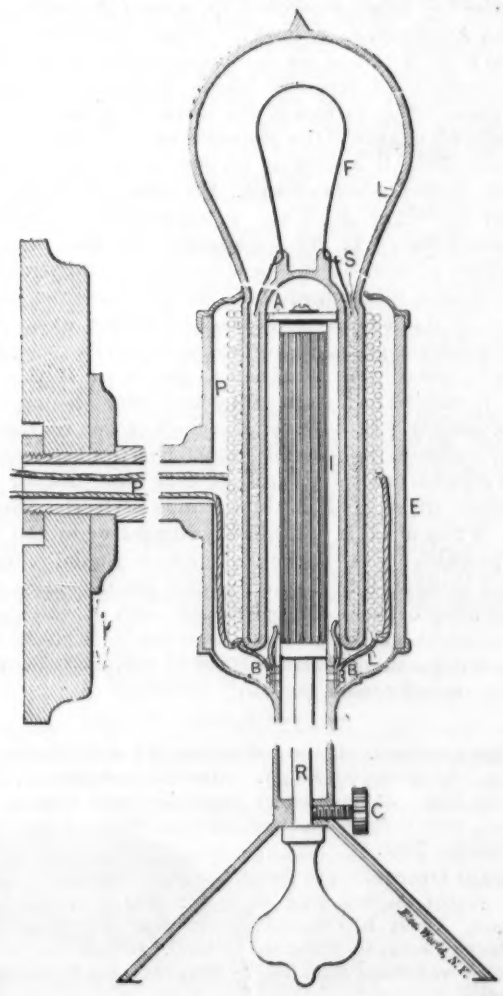


FIG. 5.—LAMP AND SOCKET.

wires *I*, and these are the means of intensifying the inductive action between the two coils. The bundle of iron wires is fixed to a rod *R*, which can be pulled up or down, and by means of which any desired portion of the iron core can be withdrawn from the coils. This weakens their action correspondingly and thus, by merely pulling down the rod *R*, the brilliancy of the lamp can be changed to any desired degree; even to a point at which the filament ceases to be incandescent. The arrangement is so contrived, that when the rod is full down, the lamp primary

* See THE ELECTRICAL WORLD, February 28, 1885.

coil is short circuited, so that no current whatever passes through it.

The manner in which the latter function is effected will be readily understood. It will be seen that two spring fingers *B B* are connected respectively to the two ends of the primary coil, and are normally out of contact. The top of the iron core carries an insulated copper washer *A*. Now when the rod is pulled full-down, the washer *A* strikes both springs, forming a connection between them, and thus short-circuiting the primary coil, so that practically no current passes through it, and hence the lamp consumes no power. If desired, of course, any ordinary cut-out can be applied to the lamp to extinguish it.

With this system, it is evident that lamps of varying candle-power can be placed indiscriminately in the incandescent branch circuits since their brilliancy depends only upon the construction and relative proportions of the primary and secondary coils. Mr. Diehl finds that a lamp having 90 ohms resistance and giving about 16 c. p. will work well with only ¼ ounce, or 50 feet of No. 29 copper wire in two layers, placed as the secondary within the lamp. The copper wire employed is bare, and the layers are wound upon, and separated by, a thin sheet of mica.

These induction lamps work equally as well on alternating currents and from 7,000 to 10,000 alternations or breaks per minute, and are found to give the best results. Where the lamps are employed on incandescent circuits alone, Mr. Diehl prefers to use the alternating current.

The lamp we have described is the latest form adopted by the inventor, but he has also devised several others, among which is one in which the lamp incloses a Siemens shuttle-wound armature, which is placed within the field of a horseshoe electro-magnet. Thus, by turning the lamp and included armature so that the poles of the latter face the poles of the magnet, the lamp lights up, while when placed at right angles to that position the lamp becomes dim.

The de Meritens Process for Rendering Iron Inoxidizable.

M. de Meritens, in continuing his experiments upon the protection of iron, has obtained some further results, which seem likely to be of practical importance. The method of protecting an iron or steel surface by the electrolytic formation of a coating of the black magnetic oxide has already been taken up in France as a commercial process. Experiments in this direction have also been undertaken in the French arsenals, and are understood to have led to satisfactory results. The details of the process, which is very simple and inexpensive, will be found in THE ELECTRICAL WORLD of Aug. 28, 1886. M. de Meritens describes his later researches in a note presented to the French Academy, as follows: "When we submit a piece of iron to the action of the current in a bath of cold water, the formation of magnetic oxide does not immediately take place. The surface of the metal is in the first place coated with a layer of the protoxide of iron. This is a body of which little is known at present; it has not been completely studied by any chemist. Berzelius undertook a prolonged investigation of the substance, but he has never completed the work. The protoxide is the least stable of the oxides of iron. If it is produced by precipitation from a salt of iron, it is immediately converted into the sesquioxide. A similar conversion into the higher oxide takes place when the protoxide formed upon the surface of the metal by electrolysis is exposed to the air, or if the electrode is allowed to remain in the bath after the cessation of the current. If, however, the sheet of iron coated with the protoxide is immediately transferred to a bath containing a solution of a suitable salt of some other metal, such as copper, silver, gold, or aluminum, a perfectly adherent layer of this metal is immediately formed upon the iron. It is probable that the action is due to a partial reduction of the protoxide by hydrogen and the formation of an actual alloy between the two metals, both of which are at the moment in the nascent condition." M. de Meritens exhibited specimens of iron coated by this process with the several metals named above.

A Boston Ball.—The second annual ball of the Boston telegraphers was given on Feb. 4, with the utmost success, at Odd Fellows Hall. Congratulatory dispatches were received from London, New York, Washington, Chicago, Philadelphia, Omaha and Helena, Mont.

Postal Officers.—The Postal Telegraph and Cable Company have elected the following directors: George L. Coe, Henry Rosener, Albert B. Chandler, Andrew Wesley Kent, Hector De Castro, George G. Ward and John O. Stevens. As President Chandler was absent from the city the annual report was not presented.

Southern Telegraph Company.—At Richmond, Va., on Feb. 1, all the property, franchises, and rights of the Southern Telegraph Company were sold at public auction to James B. Pace and John S. Wise, of Richmond, for themselves and associates, for $460,000. The Southern line extends from Washington to Selma, Ala., covering 5,000 miles of wire.

Well Done Maine.—S. D. Warren & Co., paper manufacturers, have placed 900 incandescent and 25 arc lights in the village of Cumberland Mills and Wednesday night of last week they were tried for the first time, the result being perfectly satisfactory. The large paper mills, the stores, the hall, the church, and the houses of Messrs. Longley, Warren and Ayres were all lighted by electricity.—*Bangor Industrial Review*,

Long-Distance Incandescent Lighting.*

BY M. M. M. SLATTERY.

Just now there are three systems of electric lighting by incandescent lamps presenting themselves for public favor. They are the "low tension multiple," high tension multiple series," "high tension induction," and far from being an exception to the usual rule, each claims to be the best, not one of the others being worth investing in. However that may be, it is a fortunate thing that the public at large, and gas companies in particular, have certain accurate and decided views as to the general requirements of an electric light plant, so that at the present time it takes more than a capacity for persuasion to enable a manufacturer to dispose of his goods.

You are all of you or most of you familiar with what is called the high tension and low tension systems of incandescent lighting; the low tension system, as employed by the Edison company and many others, where the costly system of copper conductors necessary to carry the current plays such a prominent and objectionable part. Take a case in point: To transmit a current of electricity of 500 ampères at a pressure of 100 volts over a mile of wire—which is rather a long circuit for this system—at a loss of not more than 10 per cent., you would require a copper conductor of very large diameter. Think of that mass of metal in the air!

It is a fact that the Edison Company claim to be able to reduce this to one-half in their three-wire system, but the increased close attention at the central station, the necessity of using two dynamos instead of one, combined with excessive fluctuations in their circuits when either side of their system is thrown out of balance, together with the complications in wiring, scarcely compensate for the saving they claim.

Another serious objection to the triple wire system is, that frequently at a certain time in the evening, when they change from two dynamos to one, one of the main wires will have to carry a load for which it has never been calculated and a considerably increased loss of energy follows. Even with half the mass of conductors and with none of the attending disadvantages referred to, it still looks formidable. I grant the fact that so far as electrical efficiency is concerned, if they do not make their third wire do too much, together with the uniformity of distribution and perfection of mechanical detail, it scarcely leaves anything more to be desired. But the public are inexorable and have passed judgment and said: "Your conductors are too large and the distance you transmit your energy too short, and much as there is to admire about your system, there are some important features still lacking."

The next system that comes in order and that has been tried, and in a great measure succeeded in meeting the public demand, is what is called the multiple series system, where groups of lamps are placed in series in the line.

In this case in the necessary wire calculations for installing, distance is a comparatively small factor—just the reverse of the low tension—because here we work with but a few ampères and at high tension. There are circuits of incandescent lamps in this city varying in length from 8 to 15 miles, and, I am told, there is one about 21 miles. This system held the field for a time until the public began to be educated, and then commenced the awkward questions such as, Why may we not turn those lamps on and off as we can in a low tension system? The usual reply was, "Oh! this is a high tension system," and they were satisfied with that reply for a season. However this question got to be repeated oftener than was good for some companies, and discussions began to take place between the public and the suppliers; the former argued that many times in the course of an evening they did not require the whole of a group of lamps in certain places, and their being obliged by the supplier to have them was no reason why they should pay for them.

The reply was for the first time a candid one, and the public scored another point of valuable information, that any number of lamps turned off in a group did not save any energy, and that so far as the supplier was concerned they might just as well use all in a group as only a few; besides, was it not worth something to have your incandescent lamps miles and miles away from the central station? Thus the public mind was for the time being fairly satisfied, but the ominous way in which it shook its head was not encouraging for the longevity of the system, and shortly it passed judgment and said, "I have nothing to say about your system of conductors. I can see you use but a small portion of copper in them. I am also satisfied with the long distance over which you can transmit your energy, and your system in many respects is commendable, but at the points of distribution of your lamps you are weak, you make us pay for what we do not use. In that you may perhaps be a bit more honest than the gas meter, for you boldly admit the charge, while that pestilential gas meter away in the corner insinuatingly runs up our account. However, I do not like the way you make us use your lamps whether we want them or not. So go to work, still giving us your light conductors, still leaving with us your advantage of long distance transmission, but let us have the further advantage of turning our lamps on and off as we may want them and we will pay only for what we use."

Well, the outcome of this new judgment at the public bar, and the new demand for something more, induced many investigators to re-enter the field for further exploration, and the result has been the development of an ideal incandescent system of distribution. You are all of you perfectly familiar with the ordinary induction coil, which usually consists of a bundle of iron wires having two coils of copper wire wound round them, called a primary and secondary circuit; the primary coil when closed round any source of generation receiving the current, the result of which is an induced current in the secondary coil. You also know that both of these coils are carefully insulated from one another. Many years ago a modified form of this same apparatus was made by a scientist whose memory is revered by us all, and whose works, whatever subject he treated upon, became the textbooks for future guidance—I refer to Professor Faraday. His experiments were of such a nature and so encouraging as to lead others to give the subject of the construction of induction coils to play some part in a system of electrical distribution some attention, and so the gems which were plentifully dropped along the electrical highway in a more or less finished condition by this great man were picked up by many earnest seekers and rubbed by the friction of thought until their brilliancy flooded the world with the effulgence of their rays.

About the year 1882, two gentlemen, Messrs. Gaulard & Gibbs, of England, were hard at work in reducing to a practical commercial basis a system of induction distribution, and important and extensive were the advances they made in that direction. Indeed their efforts were of such a character as to elicit the attention of one of the ablest electricians, George B. Forbes, who spoke in the highest terms of the system, At the same time, however, that he spoke such encouraging words he showed that there still existed some fundamental objections which had to be eliminated before a full measure of success could be obtained.

The Gaulard & Gibbs system consists in making their primary and secondary coils of the same, or nearly the same, number of convolutions and resistances, in order that the current flowing in each coil may be equal as well as opposite, this being a necessary condition for producing in such a system the best results. If, however, by any means less current should pass round the secondary coil, what might be called polar development would take place, resulting further in the development of what is termed counter-electromotive force, which proved very injurious, such counter-electromotive force being equivalent to the introduction of so much wasteful resistance in the circuit. It was found that so long as the inducing and induced current were of equal strength the iron core possessed no free magnetism, or very little, but no sooner should any departure from that take place, such as the turning of a lamp out of the circuit of the coil, an external magnetic field would at once be created. The coil would then work under great disadvantages, the wasteful effects referred to occurring.

The induction coils made by these gentlemen were worked in series in the main lines in this manner. In a circuit of constant current and varying potential the primary circuit forms a continuous part of the main line, and in the secondary a group of lamps is introduced.

Right here a serious problem had to be solved; how to turn lamps out in a group without increasing the brilliancy of those that remain, and to suppress the C. E. M. F. so disastrous to the regulation and consequently the practical use of the system. Those who have followed the many publications made by these gentlemen from time to time will agree with me that however meritorious their achievements may have been and may be, however laboriously they may have applied themselves to the work before them, they over-looked the real problems involved. It is simply a case of one of those mysteries of nature that has caused many an inventor an aching head and heart, when he finds that for years, maybe, he has been delicately poised upon the threshold of success, when almost the lightest effort, and presto, his work is done and the labor of years has grown into fruition.

The public did not have time to pass judgment on this system. Once more we go back to our great electrical father—Faraday—and following his footsteps we again pick up one of his jewel thoughts and apply it in another manner. And so we find that in 1883 a professor of the Edinburgh University, by name Rankin Kennedy, suggested the idea of taking Faraday's induction coil, and, instead of trying to operate it in series, like Messrs. Gaulard & Gibbs, to place it in multiple arc and see what would happen. Very much happened. It was soon discovered by those at work upon induction systems that the true direction for the application of the induction coil to a system of electrical distribution was indicated, and the next step was to so perfect the apparatus, which still lacked a good deal mechanically, and obtain the highest efficiency from it. Now also was it discovered that the very difficulties which caused others years of tedious labor were simply friends in disguise.

You will remember that I referred to two fundamental weaknesses in Messrs. Gaulard & Gibbs' system, namely, want of regulation in the circuit of the lamps, so that they could not turn them on or off, unless indeed you complicated matters by introducing mechanism, which was not to be encouraged; and, if the currents circulating in the two coils were not of equal strength the development of wasteful C. E. M. F., which had to be overcome by increasing the out-put at the machine. It so happens that this C. E. M. F., so disadvantageous in the Gaulard & Gibbs system, is simply salvation in a multiple arc system of induction coils, as in the latter circuit, as in any multiple arc system, a constant or nearly constant potential is a necessary condition, while the current may vary according to the number of translating devices introduced therein, whether in the form of incandescent lamps or induction coils. It will probably be in your minds that I said that in the Gaulard & Gibbs system it was necessary that the currents should be equal in both coils. Now, however, this condition is immaterial, because, as you turn off lamps in the secondary circuit of the coil and C. E. M. F. follows as a natural consequence, this latter simply tends to keep back the current from entering upon the primary circuit of the coils, and in a properly constructed apparatus this C. E. M. F. is one of its most valuable features, as the regulation of the system entirely depends upon it.

However, without going more minutely into a system that is fraught with so much interest for us all, as my time is limited and almost at an end, I may conclude by saying that the public has seen this ideal incandescent system in practical operation and passed its judgment and said: "That you have heeded my advice I can see and I feel gratified. The conductors necessary to transmit your current are light and cheap, being scarcely more than one-twentieth of those required for low tension—that means a great reduction in the objectionable net-work of wires which are rapidly becoming an eye-sore in many of our leading cities, as well as a great reduction in first cost. I also notice with pleasure that you are still able to transmit your energy over long distances, which is one of the most important features in any system of electrical distribution at the present time; but most of all do I notice the substantial advance you have made in your local regulation, as I now find that I may turn on and off my lamps at will, which is a great source of convenience to me. Your system now is all that may be desired, there is nothing else for me to suggest to you. Cordially congratulating you and trusting that your meter may be truthful, I shall be glad of an installation of a million burners."

* Abstract of paper read before the Philomathean, Boston, Jan. 28, 1887.

M. Bartholdi writes to Senator Evarts, of the Statue Committee, expressing his approval of the present method of lighting Liberty, "the main result having been attained as fully as possible under the conditions."

A New Electric Light Switch-Board.

A few years ago, when the average electric light station had but one or two circuits, a few couplings, or perhaps a rather primitive arrangement of strap switches, answered the purpose very well, but now, with 9, 10 and 12 o'clock circuits, temporary lighting, motor circuits, etc., a more convenient and time-saving apparatus has become necessary.

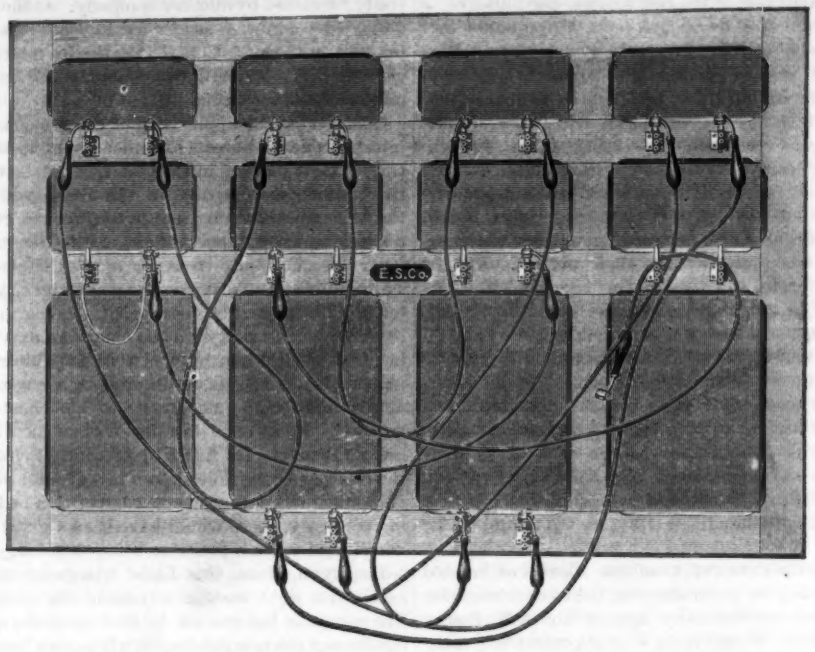


FIG. 1.—NEW ELECTRIC LIGHT SWITCH-BOARD.

The station switch-board has, like everything connected with electric lighting, undergone much study, and various forms have been devised. The latest of these, which appears to be a simple and reliable arrangement, is shown in the accompanying illustration, Fig. 1. It is made by the Electrical Supply Company, Chicago. The arrangement which is presented in detail in Fig. 2 consists in providing a taper plug *A*, over which a corresponding eye *A'*, provided with a handle, is forced when a connection is to be made. The board and connections are calculated to carry a current of 200 ampères with safety.

Each plug is provided with a socket and binding screw *B*, intended to receive the line terminal, which may be soldered for security. The screw *C* is provided for the purpose of making temporary connection between two or more circuits by means of a short length of line wire. In addition each terminal is provided with a taper hole *D* for testing purposes, a taper plug and flexible cord connecting with magneto or galvanometer being provided for the purpose. The flexible cables attached to the connection-eyes are made of specially pliable kerite wire braided, and need no additional insulation.

The board is made of black walnut, the mountings being nickel-dipped, so that the whole presents a neat appearance.

Electric Light Insurance.

It is stated that the electric light committee of the New England Exchange, in view of the fact that the whole amount of loss in their territory traced directly to electric light causes has been less than $10,000 during the past two years, and therefore believing that the interests of insurance companies would be best served by encouraging the use of such lights, under proper supervision, offered at the last meeting a resolution authorizing the committee to issue a schedule of reductions in rates that would be allowed on certain classes of hazards where the exclusive use of electricity for artificial light was guaranteed. The resolution, after some discussion, was indefinitely postponed.

Electricity in its Relation to Insurance.

Speaking on the subject of insurance at the last meeting of the Electric Club, Mr. H. Hine said:

"To-day I believe that all the insurance associations admit that the electric is as safe as other lights, and some go even further and do not hesitate to say that it is much safer when properly installed. Now this is all that the electric light companies claim. We not only freely admit, but take pains to publish the fact, that great danger would attend imperfect and careless equipment, but we emphatically assert that such work has not been the rule, and and that, as installed to-day by the reputable companies, an electric light system, whether arc or incandescent, isolated or central station, continuous, pulsating or alternating current, contains fewer elements of danger than lighting by gas or oil."

With regard to improving the rules for inspecting electric light plants to be adopted by the insurance men:

"Proper conductivity and insulation and the use of efficient safeguards in case of accident are the three essential points to cover, and I believe they can be comprehensively covered by a few simple rules. Not one of the present rules," he said, "was sufficiently comprehensive. I would suggest," he added, "that a simple and efficient rule would be one which prescribes a certain sectional area of wire per ampère of current. Another point upon which the rules differ greatly is the distance which must be maintained between positive and negative wires. If the plant is properly installed in other respects it is a question whether in most systems it is not safer to have all wires very close together. Some of the rules now in force require that a plant entire must show a certain insulating resistance. The idea of the rule is good, as it is a check on the whole work, but is it fair to require the same insulating resistance in a plant where the electro-motive force used is 100 volts as is required where it is 1,000 volts?

"Then, again, the greater the length of wire in an installation the less is its total insulating resistance, though, for a given unit of length, it may measure as high as an equal length in a smaller installation whose total resistance is much greater. It would therefore be unfair to require in large installations the same insulating resistance as in small ones. Would it not be well to avoid this unfairness by requiring a certain insulating resistance per thousand feet of circuit? Differences also exist in the present rules as to the use of fusible strips. These should be required either in both poles all through a system, or only in one, but all in the same pole, and there should be a standard metal or alloy used for the strips and their capacity be regulated by specifying a certain sectional area per ampère of current."

Lighting by Accumulators.

On the evening of Feb. 4 Messrs. L. C. Kinsey & Co., of Williamsport, Pa., took out a large party of prominent men on a special train to Montgomery, Pa., for the purpose of exhibiting the accumulator plant installed by them at the latter place. The extensive machine shops of Mr. Levi Houston have been equipped with accumulators made by the Electrical Accumulator Company, of this city, and 100 cells furnish current for 104 16 c. p. lamps in the works. The cells are charged during the daytime from a dynamo driven by the main engine, consuming for that purpose about five horse-power. After inspecting the plant at the works the party proceeded to the residence of Mr. Houston where incandescent lamps have also been installed. These, to the number of 34, are also fed from the same cells, a wire connecting the factory with the house. The great practicability of the arrangements was acknowledged by all present, and the lighting by accumulators bids fair to spread rapidly in that part of the country.

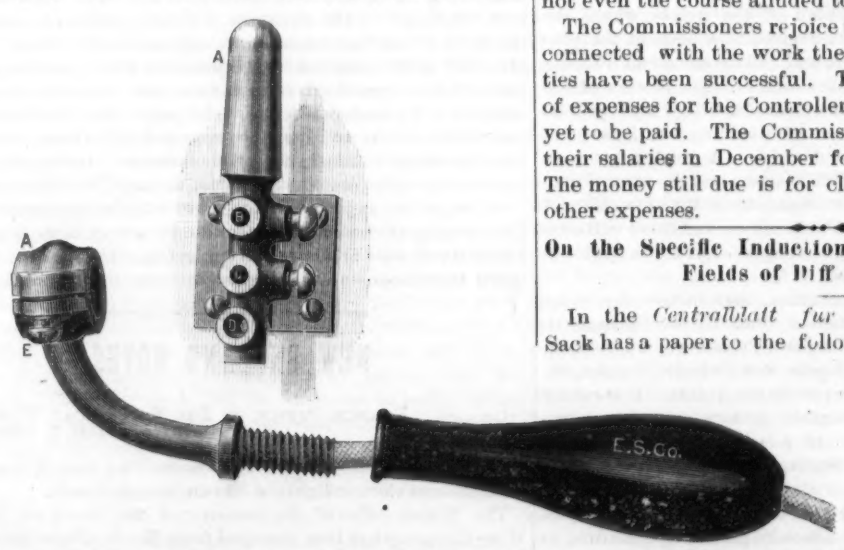


FIG. 2.—NEW ELECTRIC LIGHT SWITCH-BOARD—TAPER PLUG AND EYE.

Annual Report of the New York Subway Commission.

At the meeting of the Subway Commissioners last week their annual report, addressed to Governor Hill, Mayor Hewitt, Controller Loew and Commissioner Newton, was read and approved. "It may safely be said," says the report, "that if the Commissioners can provide satisfactorily for the proper laying of the subway, the proper allotment of spaces within it, the proper adjustment of rentals, the proper supervision of wires and freedom from interference, the proper protection from lawsuits, the proper security for carrying out the agreement, and the proper adjustment of disputes, they will amply protect the rights and interests of the people, the electric companies and themselves."

The Commissioners claim that it does not make the slightest difference to the public, or the electric companies, or the commission, who the constructing parties are, provided their security is ample, nor how much the subway costs, provided it is laid satisfactorily and honestly, nor how much the company makes on its investment, provided the charges are properly laid and reasonable.

The commission, in adopting a general plan for laying the subway, have adopted the principle of retaining in their own hands the power to adjust the details of their plan to the circumstances of cases which will arise as their work is going on. With the return of suitable weather it is expected that satisfactory progress will be made in the work. The different electric light companies in the city have made application to the commission for the construction of a conduit covering about 50 miles of street, and the telegraph and telephone companies have signified their desire for accommodation of about 20,000 miles of wire.

"Should the Legislature indicate its approval of and acquiescence in the work of the commission," continues the report, "or provide in any other way for the placing of the electrical conductors under ground, it will be impossible for the work of constructing subways to accommodate them to be completed before Nov. 1, 1887, on which day this board will expire by limitation." The feeling of the Commissioners is that the board should be continued until such time as its work can be accomplished. "If the term of office of the Commissioners," says the report, "should be extended for such time as would enable them to practically complete the work intrusted to them, after that the supervision of the electrical conductors and conduits might well be left to the local authorities or to a single commission or to such a State Board of Electrical Commissioners as has been proposed. But if the commission be allowed to expire before the greater part of its work is completed there is danger of its not being finished."

In the opinion of the board and of its adviser, the Attorney-General, it was constituted for something more than the mere approval of plans submitted to it. The failure to submit plans obliged the board to construct subways and place the electrical conductors within them. The board thinks that it can hardly be a matter of regret that the failure on the part of the electrical companies to place their conductors under ground has resulted in the perfection of a plan by which the desired results, so far as the public is concerned, can be satisfactorily attained. The board believes that, short of the construction of the subway by the city and its direct ownership by the public, no method for its construction could be found so good as the one adopted, and that it is possible that, as far as the electrical companies are concerned, not even the course alluded to would be preferable.

The Commissioners rejoice that in most of the litigations connected with the work the board and the local authorities have been successful. They have prepared their bill of expenses for the Controller. The sum of $20,431.84 has yet to be paid. The Commissioners themselves received their salaries in December for their services up to Oct. 8. The money still due is for clerks, engineers, counsel, and other expenses.

On the Specific Induction of Magnets in Magnetic Fields of Different Intensity.

In the *Centralblatt fur Elektrotechnik*, Dr. Hilmar Sack has a paper to the following effect: The specific induction of a magnet is the increase or decrease of the magnetic moment of the unit of mass by the unit of magnetizing or demagnetizing force respectively. Dr. Sack's experiments were conducted on a hardened steel bar, which had been strongly magnetized and subsequently treated for a long time in boiling water or steam, by placing it in a solenoidal coil, through which could be passed a current of given intensity either positive or negative in sign. The results are that, for magnetic fields of an intensity not exceeding six times that of the earth's horizontal component, the value for increasing and decreasing force is the same; this also holds good for fields up to seventeen times the earth's horizontal component, if the

bar be first subjected to a series of reversals of the current, for the first application of the current gives a larger value than subsequent ones. No permanent alteration in the moment of the bar can be positively detected until the magnetic field is twenty times as strong as the earth,s horizontal component.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Feb. 7, 1887.

I am indebted to Mr. Frank J. Sprague for the following very interesting notes relative to the progress of the transmission of electricity, as exemplified in the record of the Sprague Electric Railway and Motor Company:

This company was organized in the fall of 1884, and for two years was strictly a private corporation, no treasury stock having been issued, and its control and practical ownership having been in the hands of two men, Mr. E. H. Johnson and Mr. Sprague. Considering the circumstances, its success was remarkable, and by the end of 1886 it had nearly 250 machines, varying from one-half to fifteen horse-power, in operation in different parts of the country on a great variety of work. On the 31st of December, 1883, the capital was increased, and a portion of its treasury stock issued. So strong was the belief in the success of this company, and so thoroughly good a record had it made, that nearly double the amount of stock which was authorized to be issued was at once subscribed for by the few people who knew of this change in its organization. The wisdom of the Sprague Company's course seems in this way to have been made apparent. It proceeded on the basis that if it established a record and proved the success of its own experimental work, there would be no difficulty in raising whatever capital was necessary to exploit it commercially. The company now numbers among its shareholders some of the best known scientific and financial men in the country, and it seems to be well started on a very prosperous career. The organization of the company is going to be somewhat changed at a special meeting to be held on Feb. 12, and now that the company has ample capital behind it the carrying out of some very large enterprises in the way of the transmission of power by electricity may be looked forward to.

Mr. H. McL. Harding, who for the past seven months has been acting as the New England Agent of the Sprague Company, has been called to New York and appointed general agent, and his headquarters will hereafter be in this city. Mr. Edward H. Johnson will be the president, and Mr. F. J. Sprague, vice-president and general manager.

The demand for work has grown with such rapidity that it has been found necessary to make extra provision for manufacture. This work is to be divided into two classes, special and standard. Contracts are about to be entered into with the Edison Machine Works at Schenectady, one of the largest factories of the kind in the United States, for the building of standard types of machines for 100 and 200 volts electromotive force, to be run on constant potential circuits. The company are also going to build constant potential machines of 400 volts, and later of 600 to 1,000 volts for special cases of transmission. They expect to carry a stock of not less than 150 machines in Schenectady as soon as arrangements can be completed for handling them.

The Sprague company have recently leased a portion of the old Union Lead Works in West Thirtieth street, this city, and have been equipping them with the finest tools that can be purchased. They have recently added to their room, and this shop is to be devoted almost entirely to the manufacture of special types of motors, and to experimental work. Mr. Sprague will spend a large portion of his time in the factory. Some very interesting applications of electric motors are now being worked out at this factory.

The work in Boston, under Mr. Harding's active management, has been pushed ahead very rapidly; and in this connection, it may be stated that Mr. W. J. Hammer, the manager of the Edison Station in Bumstead Court, that city, has prepared a very interesting blue-print, showing a plan of the streets which are covered by the power distribution circuits, a plan of the conductors, the position of the motors and full details about 36 users of machines, nearly all of whom are owners. The powers of the machines at this station vary from one half to fifteen horse-power. They are used almost for every class of work, up to a distance of nearly 5,000 feet from the source of supply. A great many more machines are being put in at this station, and the present contracts already show a large net revenue from the furnishing of power. There are in operation ten elevators, and there will soon be ten more. At present the largest freight elevator in Boston is run by one of the Sprague motors.

Work is also extending in other cities, and motors are being introduced into Lawrence, Pawtucket, Fall River, Springfield, New York, York, Chester, Williamsport, Pittsburgh, Harrisburg, Lancaster, Detroit, Chicago, St. Louis, New Orleans, Topeka, St. Paul, Des Moines and many other prominent points. It is rather a remarkable fact that in Springfield motors are being introduced to replace the transmission of power by shafting and by wire rope at present used by the Springfield Steam Power Company.

In New York a large central station is going to be started, with motors working on either 200 or 400 volts potential, according to the distance from the station, and up to 25 horse-power, and among those who will be supplied from this station will be many requiring the hardest and most exacting duty.

The use of the Sprague motors is extending outside of the United States. They have recently been sent to Canada and the Argentine Republic, and orders for a considerable number of machines have been received from Milan and Berlin. They are likewise to be introduced into England and France. Special machines are intended for the United States Naval Service. One of the new contracts taken by the Sprague Company is for a number of special motors to be used in ventilating the new Arion Club-House which is being erected in this city. The Sprague Company are now building motors for the Electrical Accumulator Company of this city. Important contracts for over-head street line work are to be closed. Entirely new systems of surface conduits will shortly be experimented upon. The company are now contemplating the transmission of large amounts of power from a central station, aggregating as much as 1,500 horse-power.

In one sense, the most important electrical experiment ever performed is being gotten ready by the Sprague company. It will be remembered that during the latter half of the past year they were experimenting with motors on the Thirty-fourth street branch of the Elevated Railroad. On the 28th of December these experiments were brought to a close for the time being, but, it seems, only to be renewed on the most extensive scale. The company has now engaged one of the best known car-builders in the country, and is completing its designs for a 28-ton motor car. This car is to be of special construction. It will be 42 feet long. The central space is to be devoted to passengers and each end reserved for the engineer. The car is to have two trucks, each of which is to be equipped with two duplex motors of 75 horse-power each, operating upon 42-inch driving wheels. The car will, therefore, have eight 42-inch driving wheels, with four independent axles and two independent trucks, and the motors will have an aggregate capacity of nearly 300 horse-power. This is about 60 per cent. more than the present locomotives have when crowded to their utmost. All the weight of the car, 28 tons, is effective for tractive effort as against 15 tons of weight on the driving wheels of the present locomotives. Although the capacity of the motor car will be 60 per cent. greater than that of the locomotives, and its tractive weight about 90 per cent. more, the running strain on the structure is reduced about 20 per cent. because of the distribution of the weight over 42 feet instead of over a few feet as in the present locomotives. The best known firms in the country in their particular specialties are to be employed upon this car. The work is to be pushed as rapidly as possible, and when finished the car will have ample capacity to handle a 120-ton train and make time.

The General Term of the Court of Common Pleas has handed down an opinion affirming the order denying the motion made by the New York Electric Lines Company against Rollin M. Squire as Commissioner of Public Works for a writ of peremptory mandamus to compel him to grant the company a permit to open the streets.

The strike in the Edison light works at East Newark, in progress for two weeks, ended to-day. Nearly all the old employés have returned to work at the old rates. A compromise was made between the company and the Knights of Labor on Sunday night.

The Subway Commission of this city has examined the specifications for the new sections, and ordered that they should all be begun on March 1, if the frost would permit. The section beginning at Canal street and Broadway will have 27 ducts, turning at Spring street to West street it will have 15 ducts, and from West street to Fourteenth 10 ducts. The down-town section will lead from Cortlandt street and Broadway, by way of Park Row, to the Brooklyn Bridge, and the Fifty-eighth street section from First to Eighth avenues will have 15 tubes of zinc, 2½ inches in diameter. The mastic is still left to the decision of the Construction Company. The prominent citizens of Harlem have been clamorous for more light, and as a subway conduit was at present impracticable, coupled with the fact that the Harlem Electric Light Company had offered to light Third avenue between Eighty-sixth and 170th streets for nothing for three months, it has been thought a temporary permit might be granted. That company has now been given permission to string four cables on small iron poles 20 feet high and 2½ inches in diameter, not less than 500 feet apart, on Third avenue, and also on 125th street, between Third and Eighth avenues.

Speaking this week about his early and personal activity, in pushing the combination of gas and electric lighting interests, Mr. E. H. Goff remarked: "I have been a steady advocate of it for the past five years, have talked, written and worked for it both publicly and privately. The other companies scouted the idea. Now that it has become a fixed fact, and the combination of the two interests is assured, the other electric light managers, or nearly all of them, are undertaking to make it appear that they were the first in the field, and are undertaking also to curry favor with the gas companies. Of course, I can't say that I blame them very much, as I presume I should do the same thing had I also been behind in the race. As a matter of fact, while most of the managers are making this claim now with the gas interest, they are as much opposed to the scheme as ever." Mr. Goff then instanced the hearing in Boston last week, as to amendment of gas charters, and stated that while the change was objected to by various electric light people, Col. Stedman, treasurer of the American Company, appeared in its behalf and called for a favorable consideration of the measure. In fact, the American was the only company appearing in support of the measure.

As might be expected, New York will be represented at the Philadelphia electric light convention by a very large contingent, I hear on all sides of those who are going. The meeting will certainly be an important and memorable one. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Feb. 7, 1887.

There are at the present time in the City Hall of this city 42 incandescent electric lights of 32 candle-power each.

The Boston office of the treasurer of the New York Insulated Wire Company has been removed from No. 33 Oliver street to the factory at Medford, Mass.

Mr. C. J. H. Woodbury, inspector for the Boston Manufacturers Mutual Fire Insurance Company, intends, it is said, to read a paper on Thermostats before the next meeting of the National Electric Light Association.

A very interesting exhibition of electric inventions was given last week at Union Hall, Cambridge, Mass., by Professor Geo. H. Hartwell. The use of electricity, as applied to street cars, sewing machines, pumps, railroad signals, etc., was explained and the various inventions for lighting streets and interiors were shown.

In the Blue Room of the Massachusetts State House on Wednesday morning, February 2, there was a large gathering of gentlemen interested in gas and electric lighting, when the Committee on Manufactures gave a hearing upon the petitions of several gas light companies for authority to furnish electric light and power. It being understood that a general bill would be favored by the committee, some of the gas companies raised the point that certain special interests would be hazarded; and the representatives of the electric light companies objected to the subject-matter of the petitions upon the ground that the gas companies, so far as appeared, were mainly desirous to keep the electric light companies from extending their business. If a general law were passed, it should contain a proviso that the gas companies should not be authorized to furnish electric light where it is already furnished by another company. At the suggestion of Senator Jefts, the committee adjourned for one week with the understanding that in the meantime the parties in interest should submit a general bill. Matters which cannot be included, it was said, might be met by special legislation.

Considering the application of the gas companies to the Legislature of Massachusetts for amendment to their charters admitting of their putting in electric lights, it is worthy of note that there is one gas company in the State which is and has from the beginning been engaged in the business of electric lighting as a legitimate and important adjunct to the gas industry.

Mr. Geo. B. Neal, treasurer of the Charlestown Gas Company, stands almost alone among the gas fraternity as treating the matter in a liberal and business spirit. Being the first to realize that lighting by electricity was no longer an experiment, and that the business of his company was to furnish illumination without being tied to gas only as an illuminant, a prompt and business-like application for an amendment to his charter was as promptly granted. He at once installed a plant of Brush lights and has met all demands for lights by promptly increasing the plant. Had the other gas companies taken this ground instead of applying for franchise merely to prevent competition or to crush out an existing company, there would have been a great deal less opposition manifested to their petitions being granted.

The Lynn, Mass., Gas Light Company contemplates building an electric light station adjoining the premises it now occupies. The company has not yet decided upon the systems of arc and incandescent electric lighting it will adopt, but will carefully inspect the lights and apparatus of the several parent companies before making a purchase of dynamos and lamps.

As an example of what push and enterprise will do in the business of electric lighting, the increase of the business of the Woonsocket Electric Machine and Power Co. stands as a sample of what can be done among the New England companies. This company, under the efficient management of the treasurer, Mr. L. C. Lincoln, started in June, 1883, with one Armington & Sims engine of 50 h. p., one tubular boiler of 100 h. p., one 25 light arc machine and with 18 paying lights. They now have 250 h. p. of boilers, three Armington & Sims engines, aggregating 170 h. p., and have recently ordered a fourth engine of 150 h. p. Their electric apparatus at the present time consists of four arc dynamos and three of the incandescent type, and this equipment is proving entirely inadequate to their largely increasing business. If some other companies could avail themselves of such management as has been shown at Woonsocket, there would be more and larger dividends accruing in the business.

The following named Bostonians will probably be present at the meeting of the National Electric Light Convention, viz.:

H. B. Cram, representing Bernstein Electric Light Manufacturing Company; A. F. Upton, Jarvis Engineering Company; Edward D. Libbey, New England Glass Works; Frederick Swift and M. M. M. Slattery, Sun Electric Company; Frank Ridlon, Brush-Swan Electric Light Company; L. Schlegelmilch, Schaefer Electric Manufacturing Company; J. T. Wilson, Martin-Wilson Fire Alarm Company; Charles J. H. Woodbury, American Automatic Fire Alarm Association; H. McL. Harding, New England Manager Sprague Company; H, M. Clark, Eastern Electric Cable Company; A. F. Mason, Simplex Electrical Company; F. A. Gilbert and P. E. Fahey, Boston Electric Light Company; Geo. B. Neal, Charlestown Gas and Electric Light Company.

It is reported that the New England Insurance Exchange (Boston) and the Boston Fire Underwriters' Association will send a representative respectively.

Mr. N. J. Simonds, the president of the Woburn, Mass., Electric Light Company, recently purchased a 45 arc light Brush dynamo. Several of the lights were burning on Main street on Thursday evening, Feb. 3, and they gave great satisfaction. For nearly a year this company has been operating (exclusively) incandescent lights for the streets, stores and dwelling houses, but the demand for arc lights on the principal thoroughfares prompted Mr. Simonds to comply with the wishes of his fellow townsmen.

The New Bedford (Mass.) Electric Light and Power Company is reported to be doing a very profitable business. This company has just ordered another engine of 150 h. p., making the number of its engines four. The others are of 35, 100 and 125 h. p., respectively. The present lighting capacity of the company's plant is 3,500 incandescent (16 c. p.) lights, Edison system.

The Charlestown (Mass.) Gas and Electric Light Company has decided to double the present lighting capacity of its electric light plant, and to this end has ordered another boiler and an Armington & Sims engine from the Jarvis Engineering Company, of Boston.

Among the many electric light companies of New England which have already begun to feel the effects of the coal strike, are: The Woonsocket, Mass., Company and the Narragansett Company, of Providence. The former has been compelled, it is said, to burn railroad cinders, owing to its inability to get screenings, although every effort was exerted and higher prices offered. The latter company, also unable to obtain screenings, is reported to be using soft coal instead, at $5 per ton increase on price previously paid for other fuel.

General Manager Upton, of the Jarvis Engineering Company, was met by writer on the train Friday evening while *en route* for Boston, after a flying visit to North Attleboro, Mass., and Providence. He reports the contemplated increase in the lighting capacity of the plant of the North Attleboro,' Electric Light Company. The Jarvis people are putting in another large boiler, and two additional Armington & Sims engines will be in position before March 1, thereby increasing the power of the plant to about 300 horse-power. A Sprague motor has also been added to the equipment of the North Attleboro' plant, and the company is thus enabled to furnish arc and incandescent lights and electric power as well.

A new station is being erected by the Consolidated Electric Light Company, Portland, Me. The building is to be 65 x 100 feet, two stories high, and of brick. The company will now be enabled to increase the lighting capacity of its plant, and steps in this direction have already been taken. In addition to the system of arc lighting now in use—incandescent (Edison) lights and the Sprague electric motor will in the future form important adjuncts to the company's rapidly growing business.

It is said that the Synchronous Time Company, of Boston, has secured the services of Mr. John H. Burns, who has been connected, until recently, with the Somerset Fibre Works, at Fairfield, Me.

The Wainwright Manufacturing Company report the sale of their exhaust feed water heaters for the month of January as being between 1,800 and 1,900 horse-power. The business transactions between this company and electric light people have been of large dimensions and very satisfactory to all concerned.

It has been decided to introduce a system of police signals in connection with the new fire-alarm system at Brookline, Mass., and an apparatus will probably be in working order by April 1. The police will have a patrol wagon like that in use in South Boston, and keys to the boxes will be left in houses in the vicinity thereof.

At the Massachusetts State House on Feb. 4 the Committee on Cities heard the petition of the Police Commissioners of Boston for authority to introduce an electrical police and patrol wagon system. W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Pa., Feb. 7, 1887.

Electricity in its various appliances and the many purposes it has been put to have advanced to a far greater extent during the past twelve months than was looked for by the most sanguine. Miles of our streets have been lighted by electricity, hundreds of houses have been fitted with electrical appliances, such as bells, gas lighting apparatus, burglar alarms, etc., and all the new houses of any size are not considered complete without these electrical conveniences. Many of our wealthier citizens have introduced the incandescent light into their dwellings, running the dynamos in many cases with the simple form of the Otto gas engine which can be attended to by an ordinary domestic. During the past year several miles of conduits have been laid for electric lighting, telegraphic and telephone purposes, and with the opening of spring miles more will be added.

We have seen completed during the past year the finest electrical department in the world at our new public buildings under the able supervision of our city electrician, Mr. David R. Walker. The capacity in the battery room of this department is 1,500 cells. Our electrical supply people have experienced a very busy year, many new appliances having been brought out, and a vast number of new appliances and important improvements on old ones will be perfected this year. One of our supply houses is working on an incandescent meter for the registry of the number of lights used and the length of time burned in the same manner as gas is registered.

Amongst comparatively new appliances may be mentioned the return or guest call system, which is an improvement over the ordinary hotel annunciator, by which a bell can be rung in any one room to call a guest, or can all be rung at once, giving a call in every room in the house in case of fire, etc. This call is manufactured by Partrick & Carter, 114 S. 2d street.

A. F. Moore, of 200 and 204 North Third street, have the extensive new addition to their mill in perfect running order, and, with a largely increased force of hands and several important improvements, are turning out over 8,000 lbs. of copper wire daily.

The electric light cable, which is being used with such great success by our city, is manufactured by the well-known house of Tatham Bros., of 226 and 228 South Fifth street. The Traction Company of this city is using five miles of this cable, which is giving entire satisfaction,

M. R. Muckle, Jr., & Co., 108 South Sixth street, have lately installed a 200-light Westinghouse plant for Mr. J. W. Bowman, of Oxford, Pa.

James W. Queen & Co., 924 Chestnut street, are having a good demand for the Carpentier ammeters and voltmeters, and for the spring ammeters and voltmeters of Ayrton & Perry. The Wiedemann and Kohlrausch galvanometers and the Hartmann & Braun rheostats are also in active demand.

For creating the dynamo currents for telegraphic purposes the Otto gas engines manufactured by Schleicher, Schumm & Co., at 33d and Walnut streets, are giving universal satisfaction, and many of our citizens are using these engines for running their electric light plants.

In supplying surgical and dental electrical appliances, A. F. Fleischmann, of 1812 Market street, is meeting with good success. He has lately introduced a new form of cautery battery, by which the desired temperature is maintained for several hours, thus doing away with an assistant to agitate the elements.

The Keystone Light and Power Company, of 108 South Sixth street, have introduced the Westinghouse system of electric lighting into the Franklin Institute with the help of underground conduits.

Thomas H. McColin, 635 Arch street, is doing an increasing business in blue paper and prints. He is making a great success of his permanent enlargements by electric light. He has increased his facilities, and is now using two large electric lights of about 30,000 candle-power.

In the electrical appliance business, Shaw & Geary, of 53 and 55 North Seventh street, are a young and pushing house who are constantly bringing out new things. They have as well an appointed shop and as fine a collection of tools as any house in this city. They make specialties of all electrical house appliances.

The Cleverly Electrical Works, 1018 Chestnut street, make a specialty of electric bells, gas-lighting apparatus and general electrical appliances, in which line they are very busy.

Gill & Murray, Thompson and York streets, are manufacturers of globes and shades of all kinds for arc and incandescent lights. They have the largest capacity for the manufacture of these goods in the United States. They have recently made a very large shipment to the Pacific coast. For uniformity of shape and quality of workmanship their opal globes have been highly commended by the various electric light companies, the colors being so well blended as to produce a very beautiful mellow light. They extend a cordial invitation to all visitors to the convention to call on them and examine their work and to see the various processes of manufacture.

The Southwark Foundry and Machine Company, at Fifth st. and Washington avenue, are manufacturers of the Porter-Allen and the Southwark engines, which are especially designed for electric lighting purposes. They are also very large manufacturers of boilers and general machinery. A cordial invitation is extended to all visitors to visit their extensive works.

Messrs. Tatham & Bros. have recently completed a contract for the Haverford Electric Light Company, of Haverford College, Pa., for 50,000 feet of lead-incased electric light cable. This cable was constructed of seven No. 14 B. W. G. copper wires, stranded together to form one conductor, and was served with two heavy wrappings and two heavy braids of cotton, then insulated with an extremely high insulating compound at a moderately high temperature, thereby expelling all air and moisture contained therein; it was afterward lead-incased. This was of itself a marvel of mechanical skill, the lead being forced into such intimate proximity to the cotton insulation as to receive a sharp, clear impression of the braid, demonstrating the impossibility, with their process, of accidentally forming a chamber for the secretion of air and moisture. A four-mile circuit at Haverford College, Pa., was laid 18 inches underground in bare, moist earth, and completed last December. After being subjected to successive thaws and frosts for about a week, an electrical test made by Robt. H. Engle, their electrician, showed an insulation resistance of 564.57 megohms per mile and a copper resistance of 4.43 ohms for the circuit. It is the intention of the company to lay another circuit as soon as the ground can be broken easily, which will include Ardmore, an adjoining village. The circuits will be used to charge accumulators placed in subscribers' houses, for incandescent lighting. The accumulators are of the Faure-Sellon-Volckmar type, Woodhouse & Rawson lamps, and Edco dynamos, all of which are supplied by the Electro-Dynamic Company, of this city. Altogether the plant is a model one, and it is believed will surpass any suburban plant in the State.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Feb. 5, 1887.

Mr. W. H. Lawrence, general manager of the National Carbon Company, Cleveland, O., was in town this week. Mr. Lawrence's company has received some very large orders lately, one of them being for half a million carbons.

Judge Harriman, President of the Appleton (Wis.) Electric Street Railway Company, was in town this week arranging for three more Van Depoele motors to go on his road in Appleton. Judge Harriman, than whom no man is better or more widely known in his part of the State, says that the electric road in Appleton has now had a fair trial in both summer and winter and that it is a perfect success in every way. They were, the Judge says, a little bit anxious when winter was coming on, to see if the road would work as well as it had done during the summer. They find that neither snow nor sleet interferes with the working of the road at all. They have frequently this winter found the snow a foot deep on the track in the morning, with occasional drifts two or three feet deep. When this is the case, they simply hitch two of the cars together, putting a snow-plow of their own devising ahead of the forward car, and run the train, without any other aid than electricity, over the whole length of the track once. This effectually cleans the snow from the track, and it is all done within a very short time. The same method is employed, minus the snow-plow, in case of sleet. The regular running time of the trains on the Appleton electric road has not been interfered with from any cause whatever since the road was opened up for business. It is needless to say that Judge Harriman and his associates are very enthusiastic over their success in Appleton.

The following little item, clipped from a local paper, will make very amusing reading for Bell telephone men. The statement, that holders of Bell stock are hedging by buying Drawbaugh stock is especially good. "It doesn't make much matter so far as Chicago interest is concerned which way the legal cat jumps in the celebrated Bell patent case. The holders of telephone stock here are fixed in 'all ways.' There is a crowd headed by Ream which as a simon-pure speculation has furnished the funds for Prof. Gray to push his litigation. It is with this crowd a play for a big stake with a very small capital. There are a dozen rich men in the syndicate, including one rich newspaper man. They have the control of the stock of the company which would be in the field in case of success in the suit at Washington. All the money they have been called on to contribute is the necessary fund to get good lawyers and to make a good fight in the Supreme Court at Washington. The Bell telephone people have, of course, their own stock; but they have hedged many of them by buying into the Drawbaugh. The latter stock, like the Gray, can be had by joining the pool which contributes to the legal expenses. The Bell people for some reason or other seem to regard the Drawbaugh claims with a trifle more respect than they do any of the others. The only way they do this, however, is by taking it as a hedge. Openly they pooh-pooh all claims except their own patent."

I notice that the entire street car system of Minneapolis, Minn., has been sold to a syndicate of Eastern capitalists. I imagine that this will end the soda-motor tomfoolery up there, and perhaps also furnish an opportunity for the electric motor.

Quite a crowd of people, says a local paper, was gathered the other evening before the windows of the store occupied by the Edison Electric Light Company, at 113 Jefferson avenue, Detroit, attracted by a rapidly-revolving light in the window, which gave out an almost blinding brilliancy. Said Mr. John R. Markle, manager of the Michigan department of the company: "That is the first application of electricity to a revolving light of this kind, and, I think, will be a valuable advertising device." "Whose is the idea?" "Oh, it was gotten up in this store, and I suppose I may call it my own." The current was then turned off, as the rapidity of the revolution made it impossible otherwise to tell anything about the mechanism of the machine. It was then seen that the apparatus consisted of a brass turbine fan, attached to a very small motor and receiving its power from the connection of an ordinary light wire. To the fan is fastened a common bulb globe and carbon, such as may be seen wherever the Edison light is used. The current from the light wire furnishes both the illuminating and the motive power, and the fan whirls with a rapidity that rivals that of a boy's Fourth of July "pin-wheel." Mr. Markle says that the fan can be made of any size, and that by the use of a combination of colored globes an infinite variety of beautiful effects may be produced.

Here is another opportunity for electricity. The directors of the Milwaukee & Whitefish Bay Suburban Railway Company are investigating electric motors with the view of employing them on that projected line instead of steam.

The Illinois Secretary of State has granted licenses of incorporation to the following companies: The Mutual Electric Light Company, capital stock $100,000; incorporators: James E. Purnell, Carey A. Vaughan and Stephen A. Pitkin. The Chicago Electric Uterine Vitalizer Company, capital $45,000; Robert Green, Chas. H. Pfeill and William Meyer incorporators; and to The Baker Electric Company, capital stock $500,000, Lyman E. Crandall, Frank M. Sproehule and Martin McKeicher, incorporators.

The D. M. Steward Manufacturing Company of Cincinnati, Ohio, have been compelled to increase their force of workmen more than threefold during the last six months, and have added a number of new pieces of machinery during that time. They are very much behind their orders for their patent lava insulator. These insulators are in use by some of the largest electric light companies in the country. They are filling an order for one company alone at the rate of four hundred insulators per day. At a recent test by a competent electrician these insulators stood a heat test of 3600 degrees. The Stewart company's window tubes are very beautiful specimens of work, and have the advantage over hard rubber, fibre, or porcelain, in that they are not only fireproof, but stand water, acids, or any amount of exposure to heat and cold. The company's different articles of manufacture can be made in almost any size or shape. For one class of goods alone they have orders on hand for more than 400 gross, and they turn out daily about five thousand manufactured pieces, to fill orders. Their present facilities are entirely inadequate to the demand for their goods, and additional buildings will be erected in the spring.

I spent a couple of days in St. Louis this week. While there, I learned that the Parker-Russell Mining and Manufacturing Company are largely increasing their capacity. They will soon be able to produce carbons at the rate of eight millions a year. This increase of capacity is necessitated by the rapidly growing pages of their order books.

The Pond Engineering Company is engaged in the construction of several electric lighting plants in different parts of the country. They are a little embarrassed just at present on account of their inability to get Armington & Sims' engines fast enough. I understand that the Armington & Sims people are increasing their capacity, and from what I know of the demand for these engines in the West, I should think this was a very necessary thing to do.

The St. Louis Telephone Exchange, under the able management of Mr. George F. Durant, is growing very rapidly, no less than from forty-five to fifty subscribers having been added monthly during the last six months.

The St. Louis Battery Manufacturing Company, Mr. P. C. Burns, manager, are doing an excellent business at 210 North Third street. Their new battery is exciting considerable interest among telephone men and other users of open circuit batteries. This company are also agents for the Railway Telegraph Supply Company of Chicago.

I found the Shultz Belting Company full of business as usual. The demand for this excellent belting still continues unabated.

When in St. Louis, I was shown the books of the St. Louis Illuminating Company and am therefore able to give some actual figures pertaining to the business of that company. It will be remembered that this company uses the same system as that which has attracted so much attention at Vincennes, Ind., as you have noted, and of which Mr. Charles Heisler is the inventor.

The St. Louis Illuminating Company, as its books show, commenced the local lighting business in St. Louis on October 1, 1885. In a short time the company had a revenue, from the lamps which it had burning, of $500 a month. To-day the company has a revenue of $1,800 a month. The company has exactly one hundred customers, the largest of whom uses 95 lights. Many of the customers, however, have only a single lamp, and it is worthy of notice that, notwithstanding the fact that these lamps are scattered over an area of say two miles long by one mile wide, with over 50 miles of line wire circuit, the system is giving entire satisfaction. That the system is giving such satisfaction is evidenced by the fact that the books show that during the first year only $117.08 was allowed to subscribers altogether, as rebate. The books also show that at present, with a business of $1,800 monthly, the rebates only amount to $10 or $12 a month. It will be seen from the above that the company is giving to its customers a good, constant light and that its bills are collectible.

I might add that the same company has a proposition before the St. Louis Council to displace all the 14 candle-power gasoline lamps, now supplied to the suburbs at $28 per year each, with 30 candle-power incandescent lamps at $36 a year each. These suburban lamps would be a long way from the central station, and circuits 30 to 40 miles in length would be necessitated. Yet the company is abundantly willing and able to undertake to do this suburban lighting, and it feels sure, from the experience with central station lighting, as carried on by it in St. Louis for the last sixteen months, of being able to do the work satisfactorily.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following telephone stock quotations:

Bell of Mo.	$155@$157
Chicago	375@ 400
Central Union	49@ 50
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Iowa Union	16@ 19
Michigan	71@ 73
Rocky Mountain Bell	40@ 45
Wisconsin	104@ 106
United	18@ 20

W. A. K.

THE TELEGRAPH.

T. M. B. A.—Assessment No. 204 has been made for February to meet the death claims of G. H. Shape and J. G. Thornton. Mr. Shape died at Zurich, Switzerland, by drowning.

Mexican Telegraphs.—The receipts for the Mexican Telegraph Company for the week ended Jan. 29 were $4,530, and of the Central & South American Company, $8,439.

Gone with the Funds.—Mr. W. McLean, the Treasurer of the Telegraphers' Mutual Aid and Literary Association of Boston, has disappeared with nearly $900 of the society's funds. He is said to have dabbled in oil and to have suffered heavy losses.

THE TELEPHONE.

Consolidation.—The Iowa Union Telephone Company and the Iowa & Minnesota Telephone Company have consolidated.

The Flad System of lofty towers is proposed for electrical purposes in New Orleans.

Missouri.—Legislation is pending with the object of compelling the wires to go under ground in cities of the first class.

Wait for the Supreme Court.—The real inventor of the telephone was evidently a contemporary with the earliest Mason. —*Lowell Courier.*

A Chance for Dr. Holmes.—If Dr. Oliver Wendell Holmes is not too far gone, the exchange of "Hello, hello!" between President Grevy in Paris recently and King Leopold in Brussels furnishes excellent material for a supplement to the famous De Sauty ballad he wrote at the time of the first Atlantic cable.

Pennsylvania Rates.—At Harrisburg on Feb. 2, a bill was introduced in the House to prevent discrimination in telephone charges, compelling telephone companies to charge all parties equally and furnish all with equal facilities, also limiting the rental of telephones to $3 per month, where one telephone is used, and $2.50 where two or more are used by the same person, corporation, etc., and the tariff between cities or towns 15 miles apart to 15 cents for the first five minutes and five cents for each additional five minutes.

The Government Suit.—A special from Boston of Feb. 7 says: The subpœna in the great case of the United States *vs.* The American Bell Telephone Company was returned to the office of the Clerk of the United States Circuit Court to-day, the return of the marshal showing that service was made upon William G. Driver, the treasurer, and Charles E. Hubbard, the clerk of the defendant company. The return also states that the defendant, Alexander G. Bell, could not be found within the district. Appearance for the defendant was entered by J. J. Storrow and George L. Roberts.

The Meucci Telephone.—It having been stated that Mr. E. B. Welch, of Boston, connected with telephone interests, had sought to buy an interest in the Meucci telephone, Mr. Welch says that the published correspondence is authentic so far as it refers to him alone. At the time the offers were made, however, he was not, nor has he ever been, an official of the Bell Telephone Company, and in no case, he says, did he ever represent himself as an officer or attorney of that company, or as authorized to make proposals for that company. "The negotiation with Meucci," said Mr. Welch, "was opened by me solely at my own instance and for my own individual purposes. The story, therefore, that I endeavored to obtain possession of the Meucci claim for the Bell Telephone people has no foundation whatever." Mr. Welch said further that his propositions were in every case conditional upon the value of Meucci's claim being substantiated by ample evidence. As the evidence was never submitted he had no opinion to offer as to the validity of the claim.

Litigation as to Metallic Circuits.—A special dispatch from Philadelphia of Feb. 2 says: An important telephone suit, involving the right to erect and maintain long distance telephone wires between New York, Philadelphia and various large cities was begun in the United States Circuit Court by a bill in equity, which was filed this afternoon by attorneys for the Brooks Telegraph Construction Company. The defendants are a part of the Bell telephone syndicate, and have organized a corporation which has recently opened offices in various cities. A prospectus issued by the defendant company says that the telephone exchanges in New York, Brooklyn and the adjacent cities are now being equipped for metallic circuit service. By connection with these lines, Philadelphia business men will be placed in direct speaking communication with any of the subscribers to the telephone exchange in New York and the surrounding cities and villages in New York, New Jersey and Connecticut, numbering in all over 15,000 stations. The plaintiffs claim in the bill of complaint that they bought the exclusive right under the patent to make and use metallic circuits throughout the United States for a term of 17 years, from February, 1881; that they have expended large sums of money in perfecting the system, but that the defendants are violating this exclusive right. It is claimed that the rapid application of long distance telephones to modern business purposes renders the prospective value of the ownership of the metallic circuit to be contested in the courts second only to that of the telephone itself.

THE ELECTRIC LIGHT.

Canastota, N. Y., is to have the electric light. Mr. F. C. Fiske has the matter in hand.

Salem, Ind., is to be lighted by electricity. Among those interested are Messrs. J. F. Persise, B. T. Race, L. O. Saltmarsh and C. May.

Moberly, Mo.—The Moberly Electric Light and Power Company has been incorporated by H. T. Fort and others, with a capital stock of $50,000.

Nashville, Tenn.—The National Cotton Manufacturing Company have put in an engine to run their new machine shop and electric lights.

Canada.—The American Company have recently established a general agency in Canada under the management of A. R. Williams, the machinery agent of Toronto, Canada.

Somerville, Mass.—A meeting of citizens of Somerville was held last week to discuss the subject of electric light for the city. The whole matter was considered, and an effort will be made to have the city government adopt the light. At present some of the principal streets and squares are lighted by the Somerville Electric Light Company at its own expense, to show the citizens the desirability of the illumination.

Accumulators at Work.—Mr. E. H. Johnson, President of the Edison Electric Light Company, has had a set of cells from the Electrical Accumulator Company installed in his house. Formerly the engine driving the dynamo was stopped at midnight, after which gas was employed. With the accumulators added to the plant the electric light is available at all times, much to the gratification and comfort of the owner.

New York City.—The Brush Electric Light Company, New York, are busy erecting their new station on Elizabeth st., New York. They are setting ten tubular builers with the Jarvis boiler setting and Sheffield grate bars. This company was the first local electric light company to be formed in the world. They used the Jarvis setting under three boilers in the 25th street station in 1881.

Providence, R. I.—The recent trouble and fatal accident at the Rhode Island Electric Light Company, Providence, was caused by an explosion of carbonic oxide gas owing to poor combuston of the fuel. Had these boilers been fitted up with a boiler setting to utilize this gas accumulation with hot air over the fire, as are nine-tenths of the central electric light stations in New England, this sad accident could not have occurred.

Western Growth.—The Western Electric Construction Company, of St. Louis, have successfully completed Edison central station plants in the towns of Topeka, Hutchinson and Abilene, Kansas. The Topeka station has a capacity for 5,000 lights; the Abilene, 4,500, and the Hutchinson, 1,900. The Topeka plant started with a load of 2,000 lights, and the Hutchinson and Abilene with about 1,000 apiece. The three-wire system, and all the latest Edison improvements are in use, and it is thought that the work on stations, pole lines, etc., is second to none.

Looking Abroad for Territory.—The American Electric Manufacturing Company has decided upon the organization of a foreign department of its business and a company is now being formed which will control the entire foreign work of the American system. Installations are proposed for the leading cities of Europe, Japan, Australia, Mexico and South America. These plants will be put in under the supervision of the company's experts, and it is stated that manufacturers of other lighting apparatus will be challenged to a competitive test.

The American System.—Several of the gas companies are making good headway in the adoption of the American system of electric lighting. A large number of contracts from the gas people are now under consideration by the American Company. The gas companies generally are making a move before the different State legislatures for an amendment of their charters to introduce electric lighting in connection with their gas plants. The American Company in all cases is using its best endeavors to second this move.

The American Illuminating Company, of Boston, is being organized for the purpose of introducing the American system into Boston. The incorporators are Edwards H. Goff president of the American Electric Manufacturing Company; Col. William A. Stedman, treasurer of the American Company; Rowland N. Hazard, president of the American Loan & Trust Company, of New York, and others. The company is capitalized at $250,000. It is understood that work will be commenced at an early day in putting in a new plant.

Cleveland, O.—The new electrical organization formed under the title of the Brush Electrical Club is composed of experts in the employ of the Brush Electric Company. The principal object is mutual benefit, and next more thorough acquaintance with science and practice. Suitable rooms are now being sought, and the club bids fair to rank high among similar societies. The following officers have been elected: C. W. Phipps, President; G. B. Ellison, Vice-President; E. S. Stark, Secretary and Treasurer. Correspondence from all interested in electric lighting is cordially invited.

No "Pent Up Utica" for Them.—The Edison Electric Light Company, of New York, are making preparations to push their central station business all over the country. The marked success of the Boston Edison Company's station will lead to the immediate erection of ten to twelve more central stations in the Middle and New England States, to be constructed on the same system as the Boston station. Great credit is due Mr. J. H. Vail, general superintendent of the Edison Company, for the success of the Edison station in Boston, and to the Jarvis Engineering Company for carrying out his plans.

Louisville, Ky.—A special dispatch of Feb. 2 says: The lines of the Brush Electric Light Company during the heavy rain last night became crossed with those of the fire-alarm system of this city and almost every box on Main street was burned out. In consequence, the main business portion of the city is left temporarily unprotected. Had it not been for the presence of mind and the quick work of the chief operator in the signaling tower, the damage, which is estimated at $7,000, would have been much greater. When the flames which darted from the switch-board discovered to him the cause, he hastily threw a large ledger in the room upon the switchboard, and standing upon it cut off the loop in time to save the remaining portion of the system.

A Few of Mr. Goff's New Gas Contracts.—Last week contracts were closed by the Tacoma (Washington Ty.) Gas Light Company with the American Company for a plant to run in connection with their gas plant. The Seattle (Washington Ty.) Gas Company has also contracted for a plant with the American Company. The Glen Falls Gas Light Company, Glen Falls, N. Y., has likewise contracted with the American Company for a plant. The plant being built by the American Company for the Orange, N. J., Gas Company is about completed and will start up this week. The Montreal Gas Company, Montreal, Can., are negotiating with the American Company for a plant, they having decided to enter the electric light field.

New York City.—The Ball Electrical Illuminating Company desires permission from the aldermen to lay wires for supplying light and power in the streets and avenues and public places of the city, subject to the power of the subway commission, but offers no compensation. Alderman Mooney at the last meeting of the board offered a resolution granting permission to the Harlem Lighting Company to lay wires subject to the powers of the subway commission, under the supervision of the department of public works and the park department. As compensation for the privilege, the company is to maintain, free of any charge to the city for maintenance, one standard candle-power street electric light for every fifty lights furnished by the company to individuals. Both applications are now in the hands of the law committee of the board, which will report at the next meeting.

Lynn, Mass., in Darkness.—A special dispatch from Lynn of Feb. 4 says: At about 8 o'clock to-night Engineer Daniel Driscoll and Fireman John Cosgrove, of the Lynn Gas Works, detected a leak in the meter room, and a few minutes later an explosion occurred, blowing out the entire upper end of the brick building and injuring the two men. The building took fire, but the Fire Department soon subdued the flames after preventing their spread to the naphtha room adjoining. The gas supply of the city was immediately shut off, and will not be turned on again until some time to-morrow. The injured men were removed to the hospital, where their injuries were found to consist chiefly of burns, and they are not thought to be dangerously hurt. The damage to the building will not exceed $1,000, but the company's loss by escaping gas will amount to several thousand dollars.

APPLICATIONS OF POWER.

Motor Commutator Bars.—The Billings & Spencer Company, of Hartford, Conn., are now making some 6,000 pure copper drop forgings per week. They are commutator bars for electric motors, and are made in 11 sizes, coming from the drop ready for use save a slight truing up which is required.

The Fulton Street Franchise.—Corporation Counsel Lacombe has answered a request of Comptroller Loew for information as to what was necessary to be done in the sale by public auction of franchises under "consents" of the Board of Aldermen to certain street railways, including the North and East River. Mr. Lacombe, after saying that the legislative act under which the Aldermen acted is imperfect, says that notice of the sale must be advertised in two daily newspapers to be designated by the Mayor; that the Comptroller must personally conduct the sale; that a bond or undertaking should be required of the bidders; and that the terms of sale, outside of the limitations of the Common Council, may be fixed by the Comptroller. The successful bidder must reimburse the corporation that initiated the proceedings for a railroad on a given route for the expenses preliminarily incurred.

Philadelphia, Pa.—The underground railway ordinance is now to be considered by the general committee of City Councils and a strong effort will be made to have the bill passed. The motive power will be electricity, and each car in the train will seat thirty-eight persons, the doors being on the side. The rate of speed is to be thirty miles an hour, stations to be three to the mile in resident portions of the city, and four to the mile in business portions. This rate will enable trains to accomplish twenty miles an hour, allowing the difference for stops, which is almost double the speed of the elevated roads in New York. The tracks will be double, and there will be no switching between stations, which are to be inclosed. The building in each case is entered from the street, and a descent is made to the platform immediately beneath the pavement. Ventilation is fully provided for, and, in addition to the moving of trains, the subway is designed for the housing of all classes of pipes and wires.

To Help Along Cheap Fares.—Being interviewed last week as to the effect of electric motors on cheap street car fares, Mr. W. H. Hawkesworth, general manager and treasurer of the Daft Electric Light Company, said that he had recently been making some calculations on the comparative cost of horse and electric power for street railways. He found that electricity only cost about half as much as horse-power. "Could a street railway be run profitably by electric motors at a three-cent fare?" "Most emphatically yes," said Mr. Hawkesworth. "I am convinced that any of the most important roads in this city could be operated at a big margin of profit with electricity. That is not the vagary of an enthusiast, but I have carefully investigated every item of cost and I am sure that I am right. I can prove it in black and white if it is necessary. The experiments that have been made of electric motors elsewhere abundantly bear me out in my assertion. In fact the whole matter has passed out of the region of experiment; it has been demonstrated to be practical."

PERSONALS.

Mr. G. Westinghouse, Jr.—It is but a decade and a half since Mr. Westinghouse became the manufacturer of his own inventions. Now his manufactories are located on two continents, and they give employment to between 3,000 and 4,000 men. It was the popular but mistaken idea that Mr. Westinghouse was a poor boy who has attained his high position after surmounting the disadvantages of poverty. The fact is, Mr. Westinghouse is the son of a Schenectady, N. Y., manufacturer of agricultural implements, who died about one year ago, and whose works are still operated by George, Jr., and other sons who inherited it. George graduated at Cornell College just previous to the breaking out of the civil war in which he served on both sea and land; first, as engineer of the United States war ship "Muskwetah," and afterwards as a member of a New York cavalry regiment. He went to Pittsburgh shortly after hostilities had ceased, having patented a device to replace derailed railway cars, and the contract for manufacturing which he gave to the old steel firm of Anderson & Co., whose works were then located near the Baltimore & Ohio Railroad depot. About 1871 the Westinghouse Air Brake Company was formed, from which dates Mr. Westinghouse's career as a millionaire manufacturer, whose territory widened as his inventions increased.

MISCELLANEOUS NOTES.

Subways in New York.—The New York Underground Telegraph Company has called the official attention of the Commissioner of Public Works and of Corporation Counsel Lacombe to the decision of Judge Van Hoesen, of the Court of Common Pleas, that the Subway Commissioners had no authority to give the Consolidated Telegraph and Electrical Construction Company an exclusive right to lay conduits for electric wires. It has demanded that Commissioner Newton shall revoke all permits given to the Subway Commissioners and the Consolidated Telegraph and Electrical Company to open the surfaces of the streets and avenues, and that he shall refuse to give them permission to do any more work in the laying of subways. Of Corporation Counsel Lacombe the Underground Telegraph Company asks that he shall take some action to prevent the Commissioners and the Consolidated Company from continuing their work in the manner declared by Judge Van Hoesen to be illegal.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

February 8, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	27	33
Am. Tel. & Cable	71	75
Cen. & So. Am.	95	100
*Com. Tel	.....	.....
*Gold & Stock	.....	.....
*Inter. Ocean Tel.	.....	.....
N. Y. Mutual	71	.....
Pac. & Atl.	47	54
*Postal T. & C.	.....	.....
South. & Atl.	60	.....
W. U. Tel.	74	74⅛
W. U. Scrip.	64	.....
W. U. Bonds	118½	120
Mut. U. Bonds	84½	85
TELEPHONE.		
Am. Bell	208	208¾
Am Speaking	110	120
Erie	27½	28¼
*Hudson River	60	65

TELEPHONE.	Bid.	Asked.
Mexican	1¼	1⅝
*N. Y. & N. J.	88	93
N. Y. & Pa.	.....	.....
New England	43	43¼
*Southern Bell	110	130
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill	100	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	195	220
*Edison Ill	100	110
*Edison Isolated	.....	.....
*United States	35	50
*U. S. Ill	90	100
MOTOR.		
*Daft	.....	.....
*Sprague	.....	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

BUSINESS NOTICES.

We give below a classification of engines, boilers, belting, and other appliances of the electric lighting business:

ENGINES, BOILERS, ETC.

The Morris Machine Works, of Baldwinsville, N. Y., are offering automatic engines for electric light purposes, and have circulars that they will send on application to all interested.

Chandler & Taylor, Indianapolis, Ind., are the manufacturers of low-priced, self-contained steam engines, both stationary and portable, of which their catalogue gives the essential details.

The Kensington Engine Works, Philadelphia, make a good self-contained "Buckeye automatic" of high speed, for general purposes, and of unusual adaptability to electric lighting purposes.

The New York Safety Steam Power Company, E. T. Copeland, special agent, 30 Cortlandt street, this city, makes a specialty of engines for electric lighting, and now has a very large number running dynamos with marked economy and success.

Mr. George J. Fritz, 2026 South Third street, St. Louis, has made a study of the requirements of engines for electric light purposes, and now has a large variety of single and double engines for the operation of dynamos. Several steamboat electric light plants, on the Western rivers, have these engines, and report well of them.

Improved Corliss Engines are made for the electric light business by the Hewes & Phillips Iron Works, Newark, N. J., Mr. G. H. Barnard, agent, 175 Temple Court, this city. The engines are condensing or non-condensing and compound, and are guaranteed for close regulation and high efficiency. The concern make also tubular boilers of all kinds.

The Triple Thermic Engine continues to arouse great curiosity and interest, its high claims to economy of fuel challenging inquiry and investigation everywhere. Electric light people are waiting to hear more of the tests with it, but meantime can get particulars from the Triple Thermic Motor Company, 31 and 33 Broad street, this city.

The Buckeye Engine Company, Salem, O., have in use over 1,000 of their new Tangye Buckeye engine, ranging from 25 up to 1,000 h. p. These engines are built for continuous duty and heavy load at medium or high speed, and a great many may be seen running to-day in electric light stations and plants. The company make a specialty of self-contained automatic cut-off engines from 12 to 100 h. p. for running dynamos.

The Westinghouse Machine Company., of Pittsburgh, Pa., make a well known engine that has found its place in many an electric light installation, especially where lack of elbow room makes compactness of plant a consideration. The opinion entertained of the engine is evidenced by numerous "repeat" orders from electric light companies and by the fifteenth order from E. Balbach & Sons., the metal refiners at Newark and the eighteenth order from the Lawrence, Mass. Machine Shop.

The Fitchburg Steam Engine Company of Fitchburg, Mass., undertake to fit up electric light stations with engines, boilers, foundations, smokestacks, pumps, heaters, etc., and to put everything in shape for starting up as soon as the fires are under the boiler and the belt is on the dynamo. They build both high speed and low speed engines for dynamo driving, and have been leading exponents of the principles involved in the operation of dynamos by large engines and long lines of shafting, and have engines up to 250 h. p. running successfully in large lighting stations.

The Rice Automatic Engine has lately been brought to the attention of electric light people by the John T. Noye Manufacturing Company, of Buffalo, N. Y. The points of excellence claimed for it are that it is remarkably enduring, is smooth and steady in operation, and is easily set up and kept going. All the parts are carried by one strong frame. Perfect action and safety are the attributes of the governor, a most essential point of merit, and the simplicity of design serves to render the engine popular wherever used. The Rice is also said to be unusually economical in fuel consumption.

Otto Gas Engines are now to be found everywhere, and it is interesting to note that they have in Europe been considered equal to the operation of even large electric light stations. Thus at Buda-Pesth, as recently illustrated and described in these columns, a large plant depends on them solely. It is more than likely, now that the storage battery is finding its place, that gas engines will be in demand for running dynamos in isolated plants to charge the cells for stationary or locomotive purposes. Schleicher, Schumm & Co., of Philadelphia and Chicago, stand ready to supply gas engines from 1 to 25 horse power, at the shortest notice.

The Fishkill Corliss Engine is made by the Fishkill Landing Machine Company, Fishkill on the Hudson, N. Y. It is a fine example of the Corliss type of engine, and embodies several valuable modifications and improvements. The valves are all driven from one central wrist plate, moved by a single eccentric on the engine crank shaft. They are operated by the Cité patented releasing gear. All parts of the valve connections are in sight. The governor is of the centrifugal type, driven by a belt directly from the crank shaft, and has an automatic safety stop motion by which the engine can be stopped should the governor cease to revolve. The cross-head is of new and neat design, and, altogether, the engine recommends itself as well by its beauty as its strength and its economy in operation. The company have also a good horizontal tubular boiler.

The Armington & Sims Engine.—If American ingenuity in engine building had no other representative abroad than the Armington & Sims engine, it would be well exemplified. It is significant of the effect, too, that electric lighting has had on the higher development of the steam engine that this type should, by reason of its sensitively close regulation and its slight consumption of fuel, have been from the first identified with the growth of the business. We know many an electric light official who swears by this engine, and the fact of its desirability is seen in the large number in use, now over 2,000. In enlarging their extensive works, the Armington & Sims Company are prepared to meet every demand that the growth of electric lighting and the electrical transmission of power, in conjunction with steam plants, can create. The uniform and unvarying record of good work by the engine more than confirms our remarks on it in 1883, and is the best augury for the new work of the company.

The Wainwright Manufacturing Company, 65 and 67 Oliver street, Boston, Mass., report that during the month of January they have sold between 1,500 and 1,900 h. p. of their exhaust feed-water heaters, shipping 4 to New York City, 2 to Brooklyn, 1 to Tuckahoe, N. Y.; 1 to Pittsburgh, Pa.; 1 to Wilmington, Del.; 2 to Swissvale, Pa.; 1 to Boston, 1 to Chelsea, 1 to Woburn, Mass.; 1 to Leominster, Mass.; 1 to Keene, N. H.; and 1 to Saco, Me. They have also made large shipments of their corrugated tube expansion joints in New England and the West, and are erecting a purifying plant on the premises of the Union Switch and Signal Company, Swissvale, Pa. The Brush Electric Light Company, of Buffalo, N. Y., having used the Wainwright corrugated expansion joints for over a year in their large and complete plant, have found them to give such unqualified satisfaction that they have recently duplicated their order. These joints are finding a ready sale with electric light companies, as are also their exhaust feed-water heaters.

WATER-WHEELS.

Poole & Hunt, Baltimore, Md., make the well-known Leffel turbine water-wheel, as well as shafting and pulleys, on the latest and best designs. Quite a large department of their business is the making of gearing, and they pay particular attention to heavy gears.

The Leffel Water Wheel made by James Leffel & Co., of Springfield, O., is said to be as well suited to electric lighting purposes as to many others in connection with which it has won its high reputation. Over 15,000 horse-power are now obtained from water wheels for electric lighting, and this branch of the business is rapidly growing. Electricians near water-powers should give their attention to this subject.

The Victor Turbine Water Wheel is destined, we think, to play an important part in the utilization of wasted water powers, by driving dynamos for the electrical transmission of power. Last week we illustrated the fine water power plant installed at Lockport, N. Y., for the Cowles Electric Smelting & Aluminum Company, and running the colossal Brush dynamos there. This wheel has peculiar fitness for electric plants on account of its steadiness of motion, high speed and great efficiency. It is made by the Stilwell & Bierce Manufacturing Company, Dayton, O.

BELTING.

The Coiled Wire Belting Company, of 93 Cliff street, this city, have been steadily making a market for their product in the electric light field. We have seen their wire belting in use on dynamos, and have heard it highly commended for that purpose.

Roller Chain Belting.—The Roller Chain Belting Company, Columbus, O., make an anti-friction chain, manufactured from malleable iron and steel, and adapted for driving electric street cars, electric brakes, engines, machinery, etc. The importance of the question of chain belting for sprocket wheels on electric street cars, it may be stated, is being realized by a large number of those interested in the development of electric motors, and all such will do well to get the company's catalogue, embracing a large amount of valuable information on the subject.

Underwood Belting.—A belt that is in use in about 100 electric light stations, arc and incandescent, of all systems, must necessarily have strong recommendations. This belt is the Underwood patent cotton leather, made by the Underwood Manufacturing Company, of Tolland, Conn. The belt has the closest possible contact with the face of the pulley, runs without slipping and with absolute straightness upon the pulleys, and while soft and pliable reaches the highest standard of endurance. The New York agent is Mr. A. B. Laurence, of 82 John street.

The Shultz Belting Company, of St. Louis, have supplied a very large quantity of belting for electric lighting plants with so much satisfaction on the part of the users, that they are prepared for an even larger business in the future. As is well known, the peculiarity of the Shultz belting is that it is tanned on the surface only, the interior being raw hide. The company have made a direct personal study of the needs of the lighting business, and have steadily followed its development. Their book for engineers and belt users has been found of service in a great many stations.

Munson & Co., of 240-2 Randolph street, Chicago, have succeeded in putting their belting in the very front. Out West people have a habit of speaking pretty frankly of a thing as they know it, and hence we find Western Edison, Brush, Thomson-Houston, Excelsior, Mather, Sperry, and other companies uniting in a statement as to the results of their use of Munson belting. "The stretch, otherwise than the elasticity, is removed," they say; "no rivets, and perfect evenness of heft. The result is a perfect motion, which is absolutely essential for a steady light." Some of the belts made by the company for the Fort Wayne Jenney Station, at New Orleans, are unequalled in size.

"Electric" Leather Belting.—Chas. A. Schieren & Co., 47 Ferry street, New York, builded better than they knew in preparing for the market their "Electric" oak tanned leather belting whose use is now so general among electric light companies. Some 25 recent testimonials from stations and isolated plants speak of this belt in the warmest terms of praise. The absence of slipping and stretching is phenomenal, and when running from 3,000 to 4,000 feet per minute, in dynamo driving, it stands the strain admirably. The life of the belts with heavy electrical work is also quite observable. One concern says: "We notice some which have been in use a long time, and they are apparently as good as new, and run as straight as a line. We find that to run well, especially where regular motion is required, belts should be of even thickness, and this we find in your belts."

A Guide to the Use of Belting has just been issued by the Page Belting Company, of Concord, N. H. It is entitled "The Kinds and Grades of Belting to Use for Different Kinds of Work." It is supplemented by a number of eminently practical rules as to the purchase and use of belting. It is claimed by the author that there is no similar guide by which any person dealing in or using belts may determine their adaptation to the different classes of work, and hence the book is instructive and valuable. We have looked it over carefully and find it full of shrewd, pointed hints and suggestions, and embodying a lifetime of experience. The rules laid down really deserve to form a sort of decalogue in their way, and the lighting and power station engineer who lives up to them will have existence considerably brightened and helped. We note also some information regarding the "dynamo" belting made by the company. The pamphlet can be had free of charge.

OILS.

Synovial Oils.—The Synovial machinery and cylinder oils, S. Taussig, agent, 43 River street, Chicago, have found some warm advocates among electric lighting people, and are, beyond question, admirably adapted for engines, dynamos, etc. They can be used over and over again, without any loss of efficiency as lubricants, and with marked economy.

CONTRACTORS.

The Pond Engineering Company, of St. Louis, Mo., are leading western contractors for electric light plants and the various appurtenances thereto, such as engines, boilers, pumps, furnaces, belting, etc. Their long steam engineering experience is a high qualification for this work.

Edward P. Hampson & Co., of 36 Cortlandt street, this city, are contractors for steam plant equipment, and make a specialty of fitting up electric light stations. A notable and unique piece of their work is the installation for the Statue of Liberty at Bedloe's Island. The firm are agents for the Armington & Sims engine.

The Markle Engineering Company, of Detroit, are not only the representatives of the Edison Company for a large territory, but contractors for complete steam-power plants for all purposes; selling also boilers, engines, grate bars, injectors and other apparatus. Their recent work in Indiana and Michigan is extremely creditable in all respects, electrically and mechanically.

The Jarvis Engineering Company.—The electric light industry owes no small debt of gratitude to the Jarvis Engineering Company, of Boston, whose skill and thoroughness in the installation of the steam plant has done so much, not only in the way of making the light a practical success from the technical standpoint, but in enabling the stations they have equipped to earn handsome dividends. The long list of paying stations, in the construction of which the Jarvis Company have done work or been consulted in an expert capacity, is sufficient in itself to recommend the services of the company to any meditating new station work, and to show how vital to the success of electric lighting is the most careful and conscientious effort of experienced and able men in the special department of steam engineering.

TOOLS.

Sebastian, May & Co., Cincinnati, present a cheap screw cutting lathe to the notice of electricians, who require a lathe that will do accurate work. They supply lathes on trial, and will forward a catalogue of lathes, drill presses, tools, etc.

Stearns' New Bench Drill is only 24 inches high. It has a run of screw of 3½ inches. The chuck will carry a ⅝ inch round or tapered square drill. All the parts are interchangeable, and the bearings are carefully finished. There is an extension crank for large drilling. The drill is for sale by the trade or E. G. Stearns & Co., Syracuse, N. Y.

Tallman & McFadden, of 1025 Market street, Philadelphia, have probably the most complete line of metal workers' tools in this country, certainly in their own State. Their catalogue is evidence of this fact. They make a specialty of Stubbs' tools and steel, and are prepared to meet the necessities of electricians from an overflowing stock.

Edison Machine Works.—The shafting department, 121 Chambers street, of which we spoke last week, is calling attention to its machine molded pulley castings for sale at a low price. Its illustrated price list with discounts can be had on application.

E. E. Garvin & Co., 139-43 Centre street, this city, have for some time past made a specialty of tools for the electrical trade, electric light stations, etc. Their drills, lathes and planers, tapping machines, screw machines, are to be found in many electrical factories and workshops doing steady and satisfactory work. They do work to order, such as gear cutting and index drilling, and should be seen as to mechanical work and small machinery.

MISCELLANEOUS.

Electric Light Hoods are being made with much success, and at very moderate prices by Mr. J. S. Watt, of 81 Fulton street, this city.

The Vulcanized Fibre Company, of Wilmington, Del., have found a ready market for their product as an efficient insulating material. It is light, stands wear, and is easily worked, besides being inexpensive.

The Wellington Belt-Holder made by W. R. Santley & Co., Wellington, O., has enjoyed the distinction of being highly commended on the floor of the National Electric Light Convention as being a remarkably efficient device for shifting dynamo belts back and forth. A large number are already in use in stations.

Bowsher's Speed Indicator, made by N. P. Bowsher, South Bend, Ind., connects with the machinery by means of a small belt. It shows the speed continuously on a small dial, and gives notice of any variation from the desired rate. It is specially adapted for electric light machinery.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting tools, etc.

Messrs. Potter & Williams, contractors and engineers, 65 Fifth avenue, New York, have been appointed sole agents for that city and vicinity for the sale of the rocking and Sheffield grate bars. They have also received the right to set boilers with the Jarvis patent boiler setting.

Braiding Machinery has of late years come into very extensive use in the manufacture of insulated wire. The New England Butt Company, Providence, R. I., has furnished a large number to wire manufacturers. It supplies single and double winders and braiders of all kinds, for silk, worsted and cotton braid.

H. Andres; 22 and 24 North Fourth street, Philadelphia.—The only genuine raw-hide goods made in the United States. Belting, lacing and straps of all kinds or hard raw-hide, lathes, planers, lubricators, fans, blowers, vacuum and steam pumps, cotton and leather belting, emery wheels and machinery of all kinds.

Draughtsmen's Sensitive Paper, amateur photographic outfits, and other supplies of that nature now so necessary in many departments of the electrical business, are sold by T. H. McCollin, 635 Arch street, Philadelphia. A price-list should be written for.

Platinum is a metal for which most varied and important uses have been found in electrical applications. To-day the demand for it in electricity is greater than ever, and the utmost ingenuity is displayed in its employment. It is imported and furnished for scientific and mechanical uses by the S. S. White Dental Manufacturing Company of New York, Philadelphia, Boston and Chicago.

Vacuum Pumps for electric light plants are a specialty with the Clayton Air Compressor Works, 43 Dey street, this city. The concern makes a wide range of machinery, including vacuum pumps, boiler feed pumps, boilers, etc., as well as electric blasting batteries, exploders, wire, fuses, etc. Its boilers are stationary return tubular, portable, locomotive, upright tubular and sectional safety. It also makes turbine water-wheels.

Reflectors.—It is always the aim of the true business man to get the most out of a thing, and it certainly should be the aim of every true electric light man to utilise the beams of his light, whether arc or incandescent, to the fullest extent. This he can do by the use of reflectors wherever admissible, and we can cordially recommend many of these appliances as made by the Wheeler Reflector Company, of Boston and Chicago. This matter has not yet received the attention it should have.

Gear Wheels and Gear Cutting are the subject of some very interesting remarks by Mr. G. F. Grant of 366 Beverly street, Boston, with whom this difficult subject may be said to have been a hobby for many years. Our readers will be more than repaid for their trouble in sending to Mr. Grant for a copy of his catalogue. His table for the teeth of gears is very useful, while the cuts of gear teeth are quite suggestive. They show the true size and shape of all the sizes of teeth used on cut gears. Mr. Grant's services as a specialist in this line are invaluable. His handbook on the subject should be on the bookshelf of every machinist.

James Hunter & Son, North Adams, Mass., believe with reason that their patent friction clutch pulley and friction clutch cut-off coupling will be found extremely useful where dynamos are driven from lines of shafting. It does away with belt shifting, starts and stops without perceptible jar, and requires pulleys of less width. As recently improved, the Hunter clutch, which we illustrated last week, has two sets of tightening screws and levers, which makes the design more symmetrical and the clutch more powerful and better balanced. Clutches of this form are in use transmitting from 1 to 400 horse-power, with good results. The arrangement is so constructed as to allow the pulley to revolve on the shaft, or the shaft to revolve in the pulley, so that all unbalanced parts remain at rest when the clutch is disconnected.

Speed Indicators.—The way in which early electric lighting was often done, without testing or indicating instruments, was sublime in its audacity and recklessness, and nothing but the inherent merits of the light saved it from utter damnation at the hands of its happy-go-lucky friends. To-day, however, the industry, like every other that is successful, is carried on scientifically, and the electrician has at his command the most reliable apparatus for measurement and determination of electrical work, and he sees to it that similar care is taken to watch other parts of the plant. We have been more than pleased to see the improvement in this respect. No station is complete, for example, without its speed indicator, which can always be obtained at a moderate price. The Pratt, for instance, made at the electrical works, Greenbush, N. Y., is a trustworthy instrument, whose cost the superintendent will make in economy on expenses in less than a week after he gets it.

Important to Railroad Men and Electricians.—It has been ascertained that the terrible collision between a freight train and the limited express on the Chicago & St. Paul Railroad a few days ago, which resulted in great loss of life, was caused by the fact that the freight conductor's watch was seven minutes slow. He had visited the exposition at Minneapolis, and while near the electric machines his watch had evidently become magnetized and had lost the time. If his watch had been protected by the "Anti-Magnetic Shield" it would have been impervious to the electric influence, and the destruction of life and property which followed its disarrangement would have been avoided. As electricity begins to play an important role in our affairs the danger of such accidents is on the increase, and all railroad corporations should, as a matter of duty, guard against their occurrence by introducing the "Anti-Magnetic Shield" into the watches of their employés.—*Jewellers' Weekly.*

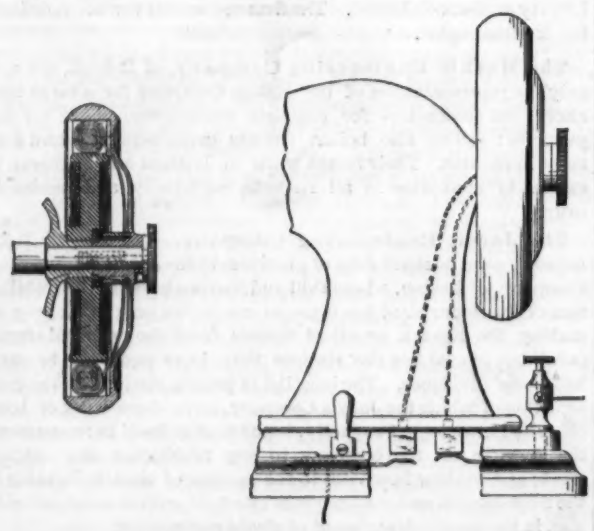
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JAN. 25, 1887.

356,496. Electrical Elevator; N. P. Otis, Yonkers, N. Y. Application filed June 14, 1886. Means are provided for throwing the operating engine into action upon the elevating mechanism gradually. Means are also provided for automatically and gradually throwing the current into the motor, thus throwing the resistance of the engine at its full operation against the motor only after the latter has acquired its maximum power or speed.

356,531. Lightning Rod; C. H. Grimes, Gratis, Ohio. Application filed Aug. 3, 1886. This invention relates to hollow rods, and it consists in providing a socket for connecting the sections of the rod which will furnish a straight and uninterrupted channel throughout the entire length of the rod.

356,576. Electric Motor; P. Diehl, Elizabeth, N. J. Application filed July 13, 1886. The motor is constructed so that it may be contained within the driving or fly-wheel of the machine to be operated, so that the wheel, in addition to its usual function, may serve as a housing for the motor. [See illustration.]



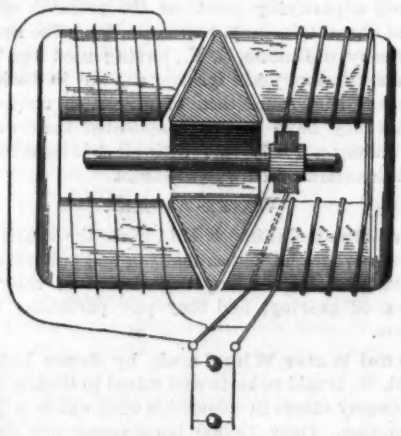
356,576. ELECTRIC MOTOR.

356,579. Electric Locomotion; H. Erbardt, Boston, Mass. Application filed Oct. 12, 1885. Special devices are provided for mounting the contact-wheels and for connecting the dynamo with the driving-wheels.

356,580. Supporting Frame for Electric Lamps; H. H. Fairbanks and W. H. Coughlin, Worcester, Mass., Assignors to the Worcester Electric Light Co. Application filed Nov. 9, 1886. A truss-like frame is provided which is suspended on two poles. A track is secured to the truss frame which carries the lamp or lamps.

356,594. Mechanical Telephone; G. W. Lord, Assignor to the Lord Acoustic Telephone Manufacturing Co., of Boston, Mass. Application filed Oct. 16, 1886. This is a mechanical telephone in which the conductor is maintained at a constant tension by the weight of the telephone.

356,605. Electric Clock Alarm; M. M. Smith and F. P. Jones, Buffalo, N. Y.; said Smith Assignor to Josephine R. Smith, of same place. Application filed April 13, 1886. The claim sets forth the invention as follows: In an electric circuit, the combination of a clock movement, a hand carried by the arbor and electrically connected with the movement, an arm projecting from said hand forming one terminal of the circuit, an insulating-ring embracing said arm, a dial, a metal washer secured to its inner edge and having a free revolvable movement, a spring projecting from said washer, forming the other terminal of the circuit, and a pointer connected with the washer and located in front of the dial.

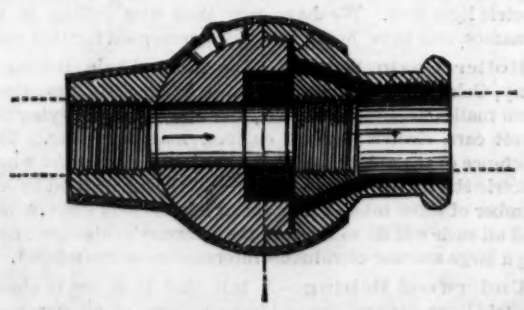


356,667. DYNAMO ELECTRIC MACHINE.

356,614. Insulated Ball-Joint; J. A. Bunnell, New York, N. Y., Assignor of one-half to J. T. Robb, of same place. Application filed Sept. 9, 1886. The invention consists of two tubular ball sections, detachably connected together, an insulator at the joint and lining one of said sections, and a socket inclosing the two sections. [See illustration.]

356,629. Insect-Catching Attachment for Lamps; J. S. Ezell, Woodruff's, S. C. Application filed June 18, 1886. The invention consists in providing a pan-like trap and devices for supporting it beneath the lamp in a convenient and detachable manner.

356,632. Electric Cut-Out; J. Fuchs, Beardstown, Ill. Application filed Aug. 3, 1886. In this device the circuit is never broken, as in most other cut-outs. The current is merely diverted.

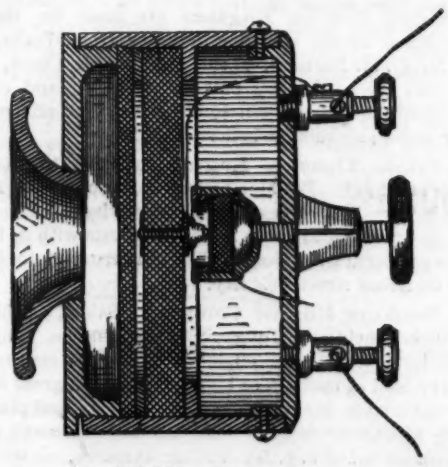


356,614. INSULATED BALL JOINT.

356,640. Process of Manufacturing Amalgams by Electrolysis; A. S. Hickley, Montreal, Quebec, Canada, Assignor by mesne assignments to the Electric Amalgam Co., of Maine. Application filed Aug. 13, 1884. The method of producing amalgams, which consists in decomposing an electrolytic metallic solution continuously circulating in a current between an anode of carbon and a cathode of mercury by means of an electric current, and thereby depositing the metallic salt upon the mercury.

356,667. Dynamo-Electric Machine; S. H. Short, Denver, Colo. Application filed May 6, 1886. Two complete magnetic systems are combined with one armature, each system having its poles in a position to act upon the armature. One of these magnetic systems acts upon the armature as a series-wound machine, the wire of the system being placed in series on the main circuit of the machine. The other magnetic system, which is distinct and separate from the first, has its poles so placed that it will act upon the same armature, but has its wire in shunt with the terminals of the machine. [See illustration.]

(1) 356,688. (2) 356,689. Telephone; E. H. Johnson, New York, N. Y. Applications filed respectively Nov. 15 and Dec. 8, 1883. (1) A diaphragm of felt is provided which controls the movements of one of the electrodes and prevents it from moving so far as to so separate the electrodes that they cannot return to their normal positions of contact. [See illustration]. (2) One electrode is secured to the diaphragm and the other to the box and the two are rigidly connected together. The instrument will maintain its adjustment and can be readily duplicated.



356,688. TELEPHONE.

356,727. Galvanic Cells; N. W. Perry, Norwood, Assignor of part to F. Forchheimer and Herman J. Groesbeck, of Cincinnati, O. Application filed March 19, 1886. An electric cell in which the conducting electrode is a plate of porous carbon floated upon the surface of the fluid and provided with openings for the escape of the polarizing gases.

10,802. Reissue. Electric Valve; W. S. Johnson, Assignor to the Johnson Electric Service Co., of Milwaukee, Wis. Application filed Oct. 6, 1886. Original patent No. 342,018. This apparatus is designed to control valves, dampers, etc. The parts are so arranged that when a circuit is closed by some exciting cause external to the valve itself, it is instantly broken by the mechanism of the valve, thus economizing in the greatest degree the electric energy.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.

WANTED.

Position in electric light factory or charge of station by a man of large experience in the manufacture of apparatus for arc and incandescent electric lighting. Address

BETA,
Branch Office ELECTRICAL WORLD,
48 Congress Street, Boston, Mass.

WANTED.

Engagement by a thoroughly competent draughtsman. Experienced in designing and arranging central stations for electric lighting. First-class references. Address

H. G.,
Care THE ELECTRICAL WORLD, New York.

WANTED.

By an experienced Electrician, at present superintendent of a large station, a similar position with reliable company or with a manufacturing concern. Well up in electrical measurement, and has made incandescent lighting a specialty. Address E. R. C.,
Care THE ELECTRICAL WORLD, New York.

FOR SALE.

125 H. P. Westinghouse Automatic Engine.
Price, $700.

Nearly new. Run less than six months. In good order. Taken in exchange for Ide engines.

A. L. IDE & SON,
Springfield, Ill.

WANTED.

Capital. A young man, now putting in an arc plant and owning valuable franchises in a western city of over 25,000 inhabitants, desires to meet a capitalist who controls $15,000 or more, and who is not afraid to *examine* an electrical enterprise, with a view to utilizing a valuable improved water power in furnishing light and power. No opposition. Address

B. M. H.,
Care ELECTRICAL WORLD,
New York.

Special Notice.

THE ANNUAL MEETING

OF THE

National Electric Light

ASSOCIATION,

Will be held

IN PHILADELPHIA,

AT THE

HOTEL LAFAYETTE,

ON TUESDAY, FEBRUARY 15,

At 12 o'Clock M.

The Executive Committee will meet at the same place on Monday, the 14th, at 3 o'clock P. M.

Members requiring hotel accommodations will please address A. J. De Camp, Chairman of Executive Committee, stating what is required.

Proposals for Lighting.

MOBILE, Ala., Jan. 18, 1887.

Sealed proposals will be received by the City of Mobile:

1st. For a system of lighting by electricity: said system to consist of not less than 125 nor more than 175 lamps, and to afford light as far as it may be possible to the whole area of the city.

2d. For a combined system of lighting by electricity and by gas, to consist of not less than thirty nor more than fifty electric lamps, and of a sufficient number of gas lamps to light in connection with the electric lamps, to the utmost limit of the territory of the city, which needs to be lighted, embracing, as far as possible, that portion of territory not hitherto lighted under the present system.

3d. For a combined system of lighting by electricity, by gas and by oil lamps, said system to embrace not less than 30 electric lamps, not less than the number of gas lamps now in use, and as many oil lamps as may be necessary in connection with the electric and gas lamps.

4th. For a system of incandescent lamps, and for a combined system of incandescent lamps and arc lamps.

All proposals to be addressed to JOHN F. SUMMERSELL, Clerk of the Mobile Police Board, and filed in his office not later than the 14th day of March, 1887.

Specifications on file and to be had on application to

JOHN F. SUMMERSELL, CLERK.

NOVELTY ELECTRIC COMPANY.

Store, Factory and Wareroom, Fifth and Locust Sts., Philadelphia. Manufacturers of

Every Description of Electrical Goods Suited to the Requirements of the Trade.

Burglar Alarm Window Springs, per doz.	$1.44	New Short Line Morse Tel. Inst., per ½ doz.	$13.50
" " Door " " "	1.50	Novelty A Battery.....(doz. lots), each.	1.15
Push Buttons, Walnut, Ash, etc., per 100.	8.00	Novelty Disque Battery (case lots 50), each.	.55
Hollow Base Switch, Walnut, etc., per 100.	20.00	Novelty Disque Battery Zincs (the best),	
Floor Push.....per doz.	3.60	per 100	50.00
Four-Point Needle Annunciator, with Bell.	5.00	Morse Telegraph Outfit, com. with battery.	3.00

SEND US A SAMPLE ORDER!

VACUUM PUMPS FOR ELECTRIC LIGHT WORKS.

For Circulars, Estimates, etc., address
CLAYTON Air Compressor Works,
43 DEY ST., NEW YORK.

ORIGINAL "CLARK" WIRE.

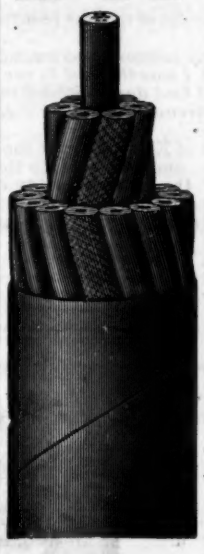
Insulation Guaranteed Wherever Used Aerial, Underground or Submarine.

In a letter from the INSPECTOR of the **Boston Fire Underwriters' Union**, under date of March 29, 1886, he says: **"A Thoroughly Reliable and Desirable Wire in Every Respect."**

The rubber used in insulating our wires and cables is specially chemically prepared, and *is guaranteed to be waterproof*, and *will not deteriorate, oxidize* or *crack*, and will remain flexible in extreme cold weather, and not affected by heat. The insulation is protected from mechanical injury by one or more braids and the whole slicked with Clark's Patent Compound, which is water, oil, acid and, to a very great extent, fire proof. *Our insulation will prove durable when all others fail.* We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph, Telephone and Electric Lights from stock. Cables made to order.

EASTERN ELECTRIC CABLE COMPANY,
61 and 63 Hampshire Street, Boston, Mass.
HENRY A. CLARK, General Manager. HERBERT H. EUSTIS, Electrician.

DAY'S KERITE INSULATED WIRES AND CABLES,



18 CONDUCTOR TELEGRAPH CABLE.

For Telephone, Telegraph and Electric Light Use, and Electrical Circuits Generally.

The reliability and durability of Kerite Insulation is unsurpassed, as has been proven by years of experience. All rubber and gutta-percha compounds are very short lived when placed either in the air or under ground, and the supposed new insulating compounds now being presented to the public, are most of them old and discarded experimental products. The present high standard and uniform quality of Kerite is the result of 30 years' experience.

The attention of **Telephone Managers** *is especially asked to our* **Anti-Induction** *Telephone cables, they being the most practicable and durable in the market.*

Telephone, Telegraph *and* **Electric Light Wires,** *for either* **submarine** *or* **underground** *work, a specialty. Estimates for complete systems of underground wires and conduits will be furnished on application.*

AUSTIN G. DAY, SOLE MANUFACTURER.

CLARK B. HOTCHKISS, Gen. Agent,
16 DEY STREET, NEW YORK.

A. L. BOGART'S

Patented Electric Gas Lighting Apparatus.

Office and Salesroom: 22 UNION SQUARE, N. Y.

ELECTRIC

Gas Lighting Burners

OF EVERY

KIND AND DESCRIPTION.

Also all supplies necessary to their application, in the fitting up of public or private buildings, either for multiple or hand-lighting apparatus.

SOLE PROPRIETOR

OF

BARTHOLDI Automatic Burner.

BARTHOLDI BURNER.

No. 1.—PLAIN PENDANT BURNER.

The attention of the trade is called to late improvements in the "Bartholdi," by which not only have all faults been corrected, but additional advantages added, making it the *sine qua non* of all automatics.

No. 3.—RATCHET PENDANT BURNER.

It may be readily taken apart for examination without removing from the fixture.

The valve may be gotten at for purposes of cleaning, should any deposit take place, without disconnecting a wire.

It cannot be turned on by accident.

Is sure and positive in its action.

Does not contain any of the objections which all other automatics are subject to.

No. 3c.—RATCHET PENDANT BURNER, BOSTON STYLE.

George H. Pride, Electrician, Telegraph Engineer and Contractor, 9 Dey Street, New York.

SHORTHAND Writing thoroughly taught by mail or personally. Situations procured all pupils when competent, and for circular. W. C. CHAFFEE, Oswego, N. Y.

CONDENSERS.

William Marshall, Mfr. Elec. Condensers. Standards a Specialty. Rooms 2 and 4 University Building cor. Waverley and University Places, N. Y.

Telephone Stocks

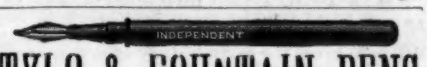
Of all the Different Companies

BOUGHT AND SOLD ON COMMISSION

ALSO

Chicago Local Stocks and Bonds.

S. G. LYNCH, 146 La Salle St., Chicago.



STYLO & FOUNTAIN PENS.

Inkstand and Penholder combined, fitted with best quality Gold Pen, and guaranteed perfect in all its parts. Fountain Pens from $2 according to size, holder and Pen. An excellent Stylographic Pen from $1. By mail on receipt of price. Send for circulars and price lists. Agents wanted. ULLRICH & CO.,
106 Liberty Street, New York.

CHARLES H. HINDS,

MANUFACTURING ELECTRICIAN.

Frictional Electric Machines and Burners for Gas Lighting by the Multiple System for Public Buildings, etc.

LIBERAL DISCOUNT TO THE TRADE.

418 W. Twenty-seventh St., New York.

THE "ELGIN" TELEPHONE
For Private Lines and "Exchange Line System."

Copied by many, excelled by none. Made wholly of metal and nickel plated. For sale by *E. S. Greeley & Co., New York; Boston Electric Co., Boston; Electrical Supply Co., Chicago.* It being the standard for mechanical telephones. Address, with stamp for circular, **"Elgin" Telephone Co.,** Elgin, Kane Co., Illinois, U. S. A.

SEBASTIAN, MAY & CO.'S
IMPROVED $60
Screw Cutting Lathe.

Designed especially for electricians and others requiring a lathe for accurate work. Catalogue of Lathes, Drill Presses, Tools, etc., mailed on application.

LATHES ON TRIAL.

163 W. Second St., Cincinnati, O.

Morrison's Practical Engineer.

A concise treatise on Steam and General Machinery. Also Practical Tests on Electric Lighting. 172 pp. Second edition, revised and improved. **Mailed on receipt of $1.00.**

W. A. MORRISON,
Box 373. LOWELL, MASS
Mention this paper.

PRICE 5.00 STEARNS' NEW BENCH DRILL

LOW IN PRICE.
HIGH IN FINISH.

24 inches high. Run of Screw, 3¼ inches. Bearings carefully finished with standard reamers. All parts interchangable. Extension crank for large drilling. Chuck holds ¾ round or tapered square drill

FOR SALE BY THE TRADE
or
E. C. STEARNS & CO.
SYRACUSE, N. Y.

SEND FOR CIRCULAR.

The C. & C. Electric Motor Co.,

2 Wall Street, New York City.

This company is now prepared to furnish motors of ⅛ horse-power and upwards of unrivaled efficiency, convenient in form, neat in appearance, cheap and durable.

For sewing machines, jewelers' lathes, dental engines and other small power.

Our battery the most efficient; furnishes ample power for motor or six-candle lamp or cautery etc.

Also special motors for use on lighting circuits for larger power, and *vice versa*, with steam power for electric lighting in small quantity.

PLATINUM

For Scientific and Mechanical Purposes,

IMPORTED AND FOR SALE BY

THE S. S. WHITE

Dental Manufacturing Co.

PHILADELPHIA. Chestnut St., cor. Twelfth;
NEW YORK, 767 and 769 Broadway;
BOSTON, 160 Tremont Street;
CHICAGO, 14 and 16 E. Madison Street.

TO AMERICAN ELECTRICIANS, INVESTORS OR PROMOTERS.

THE WELL-KNOWN M. HOLROYD SMITH SYSTEM OF ELECTRIC RAILWAY.

FOR INTRODUCTION IN THE UNITED STATES.

The inventor of this important and complete system—which is now, and has been for some time, in so successful practical operation at Blackpool, Lancashire, England—is at present actively engaged introducing it in Marseilles and Paris, France, and in incorporating Italian companies. Plants are also being placed in different parts of England.

Messrs. J. Lord & Co., the noted chartered Accountants, of London, after examining into the matter and comparing balance-sheets, have advised the West Metropolitan Railway Co. that with the Holroyd Smith system the Electric Road can be run for 50 per cent. of what a horse road can be operated for—per car per mile.

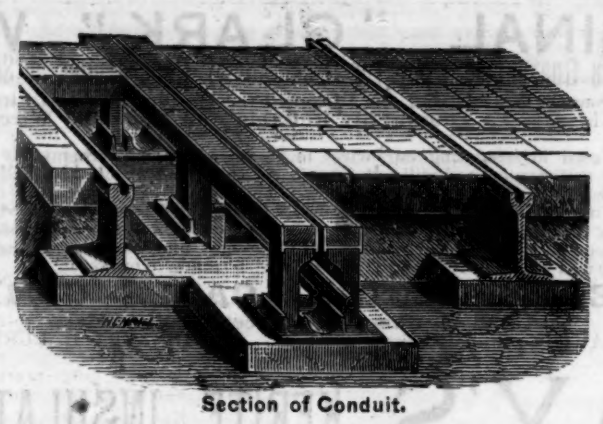
Extract from a letter giving Holroyd Smith's claims of priority.

LONDON, December 10th, 1886.

"I must again remind you of my true position respecting the use of electricity for the propulsion of tram cars, etc.

"The paper read by me at Southport in September, 1883, before the British Association (which has been sent to you Mr. Mitchell) gives the early history of my invention, a print of this paper in *The Electrician* and also in *The Mechanical World* (both of London), as well as the publication of same in various scientific papers with illustrations, clearly proves that I was then acknowledged the first practical inventor in employing an underground channel for the conveyance and protection of the conductors for supplying electricity to the motors of the tram cars. This I am able to prove by some of the first authorities in England and by the Government Electricians as well.

"I would therefore call your special attention to this fact, as it was not until the reports on my work done, as published here and possibly in the United States, that any similar attempt was made in the United States (so far as I can ascertain) on my line of working. Further than this: if the published accounts of the trials in the United States are correct, then they are simply imitations of my work, imitations so close in fact that not only the good points, but also the very *faults* of my earlier and progressive experiments have been copied; while as I have progressed and improved my work from time to time, I have in my later patents discarded these errors.



Section of Conduit.

"My experience in practical working of my Blackpool line has enabled me to realize the numerous difficulties pertaining to this subject, all of which by carefuly study and practice I have overcome.

"I now assert and believe that it would be difficult, if not impossible for any one to overcome these very difficulties without infringing one or more of my patents taken out to secure the following condition:

1st. Good and thorough insulation of exposed conductors, and avoiding all danger therefrom.
2d. Ready and quick renewal of same in case of need.
3d. Continuity and uniformity of surface and a provision for expansion and contraction of parts.
4th. Making and maintaining a good contact between the traveling collector and conductor without danger from short circuit.
5th. Safe and efficient means for cleaning centre channel.
6th. Dealing with points and crossings.
7th. Conveying the electric current from the line to the cars, and the general economy of my whole system.

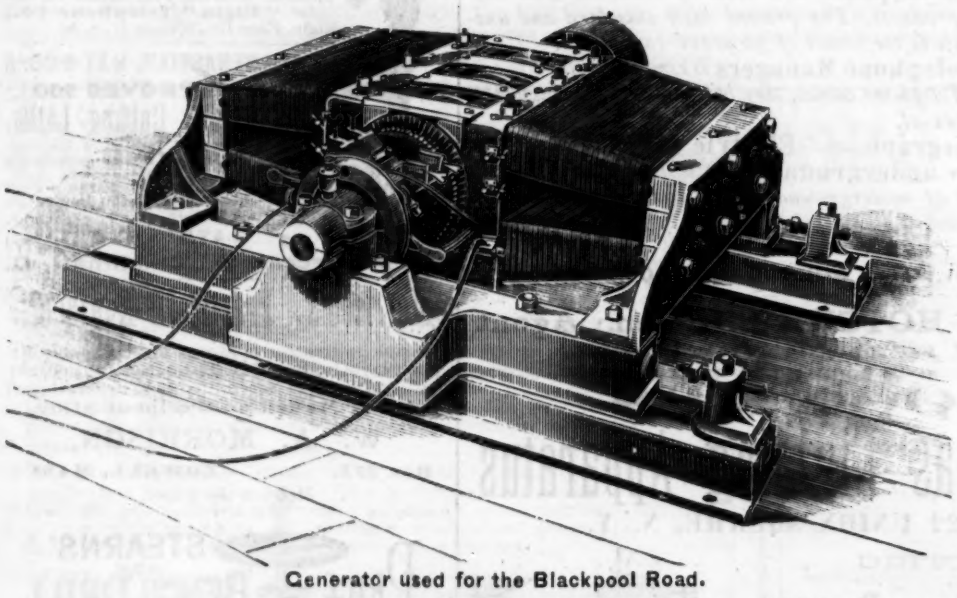
"I again assert that I am certain I am the first to employ a centre channel for the conveyance of the electric current to the Tram Car Motors, and that my American Patents antedate all others so far as I have been able to ascertain.

"I inclose you a prospectus (proof) of my new Company about starting here, and the Directors of which have been busy for three months past in making the most searching examinations into the priority and value of my system as well as the validity of my patents.

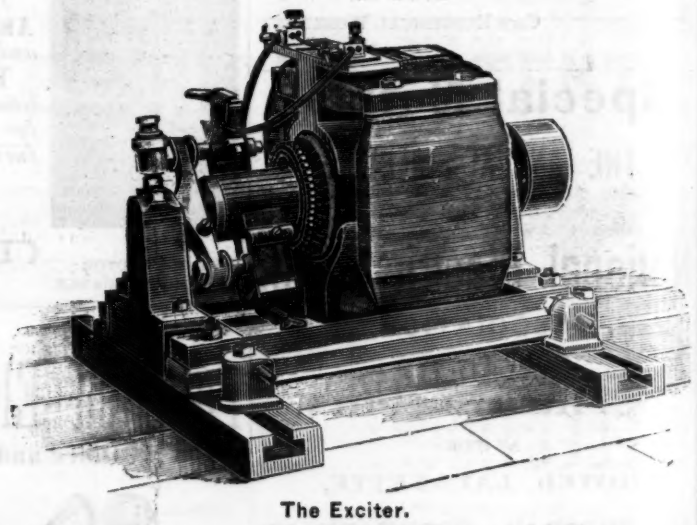
"In obtaining this information they have had various interviews with some of the best known Electricians in no way in my interest, and amongst others the Editors of *The Electrical Review*, of London, who are acknowledge as the first authority in Electrical matters, and their testimony was of the most positive kind that *I was the first to use* the Underground Channel, and they considered that *I held* the '*bottom patents*' for the system I advocate, and that *they could not see how any one could accomplish what I had done without infringing my patents*, and that they 'not only believed my inventions on this line were *entirely practical* and that my interests *were well protected*, but that my patents were extremely valuable.' And such evidence from *such a source* I do most certainly think is of sufficient importance to me it the most careful attention.

"I therefore desire you to present these remarks to Mr. ——, in the hope that when he is ready to take up any system of Electricity for the propulsion of Tram Cars, that he will see it to his interest to look into and adopt mine, as I should exceedingly regret to be placed in a position antagonistic to any one in the U. S., and be forced, in the protection of my rights, to obtain injunction which would restrain the advance of Electricity as a means of propulsion for Tram and other Cars. I am entirely convinced of the utter inutility of Secondary Batteries on any Road on which the traffic will support any other initial expense than Horse-Power."

(Signed.) Yours truly, M. HOLROYD SMITH.



Generator used for the Blackpool Road.



The Exciter.

REPORT FROM BLACKPOOL ELECTRIC RAILWAY CO.—(M. Holroyd Smith's System.)

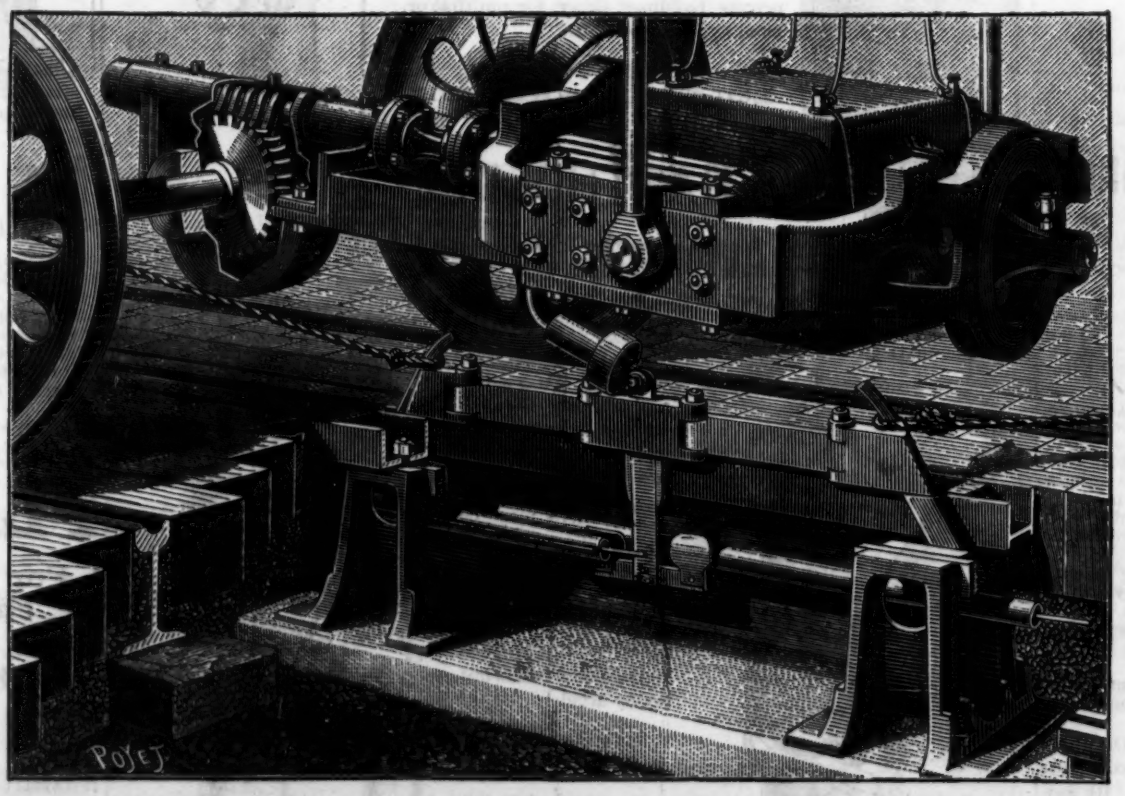
FOR THE SIX DAYS ENDING AUG. 13, 1886 (NOT RUNNING SUNDAY).

Passengers carried (without the slightest interruption) over	42,000
Total expense of coal to drive dynamo, oil, tallow, waste, etc., under	$25
Wages and salaries of all kinds	205
Total expenses for six days	230
Receipts from passengers (fare 4 cents)	$1,500

REPORT OF SEPT. 13, 1886, FOR WEEK ENDING SEPT. 11.

Ran 2,760 miles and carried 44,306 passengers, earning	$1,740
At a total cost of	230
Profit for the week	$1,510

Having FOUNDATION UNITED STATES PATENTS for Underground Conductors, in connection with Electric Motors, and all the necessary appliances for AN ABSOLUTELY PERFECT SYSTEM OF ELECTRIC RAILWAY WHICH WILL WORK UNDER ALL CONDITIONS, the American representatives of Mr. M. Holroyd Smith are desirous of having the system PRACTICALLY INTRODUCED and OPERATED IN THE UNITED STATES.



View of Motor and Track, Blackpool, Eng., Electric Railway—M. Holroyd Smith System.

State or Territorial Rights can be Purchased for the Exclusive Introduction of this System: but the main object is to Incorporate a Parent or United States Company.

References, Details, Plans, Specifications, and all information in reference to the introduction of this system of Electric Railway in the United Sta will be furnished by applying to

PHILIP S. JUSTICE & CO., 14 North Fifth Street, Philadelphia, Pa.